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Tools for Manufacturing a Musical Instrument

Press Tools for Work Requiring Close Limits — Milling Strips of Thin Brass Concave with a Straight Cutter — Tuning to a Master Instrument

By C. R. BAGGETT

SHORTLY after the armistice in 1918, the writer was concerned with the proposition for producing mouth organs on a large scale in an English shop. A close examination of a German sample showed that it was not such a simple proposition as might be

FIG. 1. THE FINISHED MOUTH ORGAN

imagined. Considerable time was spent in searching for literature dealing with the manufacture of mouth organs, but after enlisting the aid of the Board of Trade and the Patent Office without success, we came to the conclusion that an original investigation and analysis of the German sample must be resorted to.

This was done with the aid of the microscope, microphone, scleroscope and by chemical analysis, and I think that the knowledge gained is well worth recording and that rough sketches of the tools used will be interesting. Fig. 1 represents the organ in its finished state; a twenty-reed instrument with a metal comb. It is perfectly hygenic in so far as it can be boiled in water without detriment. This is a great advantage over the organ with a wooden comb which swells and distorts after being played a short time. In addition to the comb there are twenty-four components necessary for the completion of one organ; two reed plates, twenty reeds and two covers. It will be seen that it is essentially a press-tool job, and that it necessitates extreme accuracy will be realized later. The reed plates are stamped out of ordinary strip brass, but the reeds themselves must be made from a special brass rolled as hard as possible, and blanked out with the grain of the metal running lengthwise along the reed. This compelled us to cut the metal into strips 4 in. long, the width to which the brass was rolled. To produce the varying notes the reeds are not only made in two widths and different lengths, but they are milled to different thicknesses. The smallest reed produces the highest note and has to be milled to 0.002 in. on the extreme end. This is where the element of accuracy creeps in. Furthermore, to produce a good full-bodied note without having to blow hard, the clearance between the reed and the slot in the reed plate should not exceed 0.001 in. at the sides and 0.003 in. at the ends, when assembled. On the other hand, should the reed touch the sides of the slot, no note at all can be produced. There are four possibilities of error in this respect; the width of the slot in the reed plate, width of reed, position of hole in reed plate in relation to slot and position of hole in reed. An error of 0.00025 in. multiplied by four will cause the reed to touch the sides of the slot unless one error counteracts another. This need for accuracy, in addition to the fact that the reeds had to be blanked after the milling operation convinced us that a subpress type of tool should be used where possible.

The tools for producing the covers of the organ are so simple that they do not warrant much description beyond saying that for blanking and piercing, a French type progressive tool was made, and the subsequent operations were simply forming and embossing. It may be interesting to add that the covers were blanked from steel sheets 30 x 20 x 0.020 in. previously nickel-plated on one side.

The comb is a die casting of suitable alloy, similar in shape to the wooden comb, and made as light as possible. It is finally nickel-plated and polished. Fig. 2 shows the manner in which the reed plate was stamped by giving just an outline of the tool sectioned in the center. Brass strip the same in width as the finished plate was fed through the tool to a stop (not shown) and each blow of the press produced a plate complete by rounding the ends and piercing the slots and holes at the same time. The die *A* was dovetailed in the bolster, while the punches *B* were held in the punch holder *D* by riveting them at the back. A great

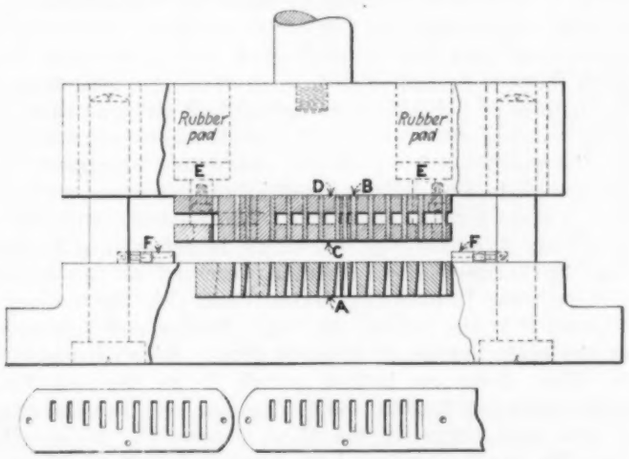


FIG. 2. TOOLS FOR BLANKING THE REED PLATE

deal of pressure was required to strip the brass from the punches, and the stripper *C* actuated by the four rubber pads through the plungers *E*, served this purpose in addition to keeping the fragile punches steady

when entering the die. Since only a rough idea of design is intended in these sketches, no further description is necessary with the exception perhaps of explaining that four pillars were used, and *F* and *F* represent two guides with spring plungers to keep the work in position. The ten small holes in the plate for riveting on the reeds were pierced by the tool shown in Fig. 3. The die *A* is shown built up in sections with one piercing hole in each piece. This enabled the necessary accuracy to be obtained by eliminating the shrinkage in hardening that would occur if made in one piece. The small punches *B* are let into round holders *C* to strengthen them and also to make broken punches an easy matter to replace. The diameter of these punches is 0.040 in. and the thickness of the reed plate is 0.035 in. The plate is placed in the die so that the stops *D* and *D* fit in the slot at each end, and the stripper *E* holds the plate in a flat position while it is being pierced, and finally strips it off the punches. To eject the plate from the die, the plungers *F* and *F* are operated by a single lever in front of the tool.

It will be seen that the slots in the plate for the reeds are of ten different lengths varying from $\frac{3}{8}$ to $\frac{1}{4}$ in. In order to blank out the reeds with the grain of the metal lengthwise, it was necessary to cut the roll of metal, which was 4 in. wide, into strips of the various widths. This was done by a simple shearing tool in the press. The next operation involved the milling of the strips and as the metal was only 0.011 in. thick and had to be milled, in the case of the high notes, to 0.002 in. on the ends. The operation was indeed a delicate one. Furthermore, in the case of some reeds, the milling had to be slightly concave in the middle. To avoid the chattering on this operation a fine-pitched spiral milling cutter was used, and to obviate the difficulty of grinding the cutter slightly convex, the necessary shape was put on the milling jig. In other words, the shape was transferred from the cutter to the milling jig, and the thin brass being forced by the action of the cutter on to the jig, the required shape was produced. Of course, the brass strip was held down on the edges by clips. When we came to the blanking of the reeds we had to decide upon the method of feeding the strips into the press tools. Owing to the length of the strips being limited to 4 in., roller feed was out of the question. To adopt side-cutter feed was difficult and expensive since it would have to be embodied in each of the ten reed tools. So the idea of notching one edge of each strip, as shown in Fig. 4, was resorted to. The whole edge was notched in one operation by a simple press tool arranged to accommodate the different widths of the brass strips, Fig. 4 gives a rough idea of how the reed tool was constructed; *A* is the top die which is screwed solid to the top bolster; it is circular, recessed at the back and cut away to miss the guides *C* and *C* in the manner shown; *B* is the bottom die, also circular and recessed at the back, but is not screwed down. When in action it slides down on bottom punch *D* as the top die approaches and is returned to position by three springs *E* and kept there by the three screws *F*. Punch *D* has the small piercing hole opened out at the back for the piercings to get clear away, and is riveted to the pad shown doweled and screwed to the base *G*. The top punch *H* is the same as the bottom punch *D* with two exceptions; it is not doweled but slides up and down inside top die *A*, and the small hole is made parallel to support the piercing punch *J*, which in its turn is riveted to the pad, as shown screwed to the top bolster.

The function of plunger *K* with the spring at the back is obvious. It will be seen that by this method the unevenness, caused by the strip being milled, did

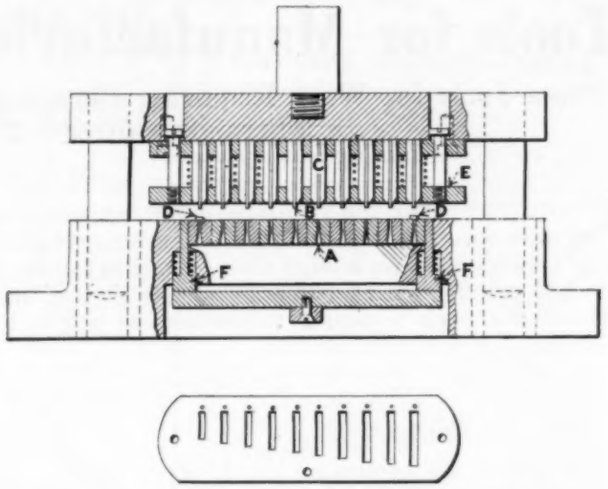


FIG. 3. PIERCING TOOLS FOR THE REED SLOTS

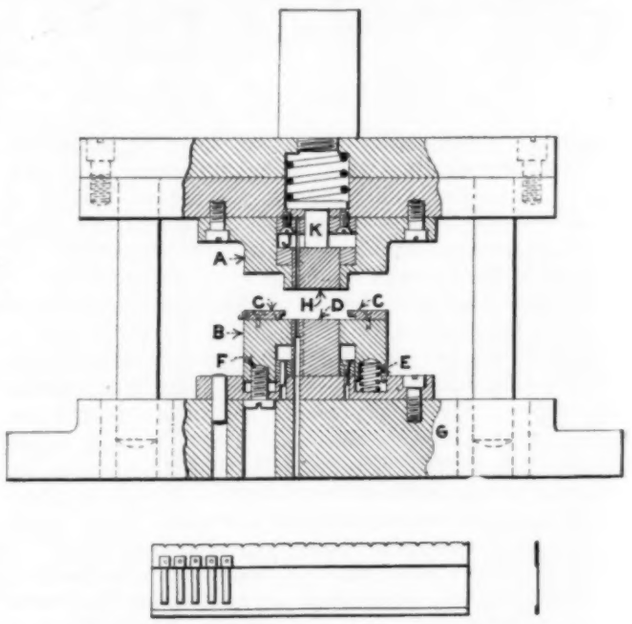


FIG. 4. TOOLS FOR BLANKING THE REEDS

not affect the blank, as the metal was held between the faces of the tool while being blanked and pierced in the one blow. The blanked pieces, of course, were forced back again into the stock and only the pieces from the small piercing hole dropped away from the tool. In one of the guides *C* and *C*, three spring plungers were inserted with ends shaped to fit the notches in the brass strip. These plungers insured the feeding of the strip through the tool and kept it in position.

The next operation was riveting the reeds on the plate. This was effected by placing the reed in the slot in the plate and holding it with thumb and finger in position in a small power riveting press which riveted the reed in one blow. Small iron rivets were used and applied with a pair of tweezers. The reeds were then tuned before assembling the organ. On the

question of tuning it is generally known that the greater the number of vibrations per second given off by a reed or string the higher the note. The vibrations of the reeds cannot be altered in this respect by blowing hard or less hard, but by increasing or reducing the flexibility. This is effected by filing the reed thinner at the tip or at the heel. For instance, if the reed was half a note sharp, just a touch with a small file at the heel would be sufficient to correct the note, as the reed is made more flexible and consequently the number of vibrations per second are lessened. Filing the tip of the reed thinner has a tendency to stiffen it and increase the number of vibrations per second. On the face of it this may seem strange, but the effect of it is certainly to produce a higher note. Fig. 5 shows the instrument devised for tuning the reeds. *A* and *A* are pipes to which rubber tubes are attached, carrying a blast of air into the reservoirs *B* and *B*. The arrows indicate

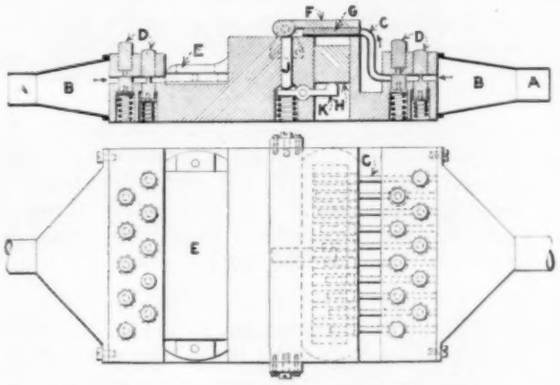


FIG. 5. THE MASTER ORGAN AND ARRANGEMENT FOR TUNING THE REEDS

the direction of the air through the ten brass tubes *C*. The valves *D* are shown both open and closed. There are two sets of valves, one to operate the master organ shown at *E* to which the reeds are tuned, the other to operate the reeds being tuned.

By this means each reed can be treated until it is in complete harmony with the master. The flap *F*, when raised to an angle of 45 deg., allows the plate to be pushed in between slides. Attached to flap *F* is a piece of sheet rubber *G* cut to the shape of the comb for the purpose of making it as airtight as possible, when pressed onto the reed plate. To facilitate the filing of the reeds, a rectangular platform *H* with raised pieces to fit the slots in the reed plate, moves up to support the reeds as the flap *F* is raised to a vertical position. The cam on the hinge of flap *F*, the plunger *J* and lever *K* explain how platform *H* is raised. In operation the plate is slid in when the flap is at 45 deg. The flap is then closed and a reed is tested by pressing the valve down with the finger. If the note is sharp or flat by the master note, the flap is raised to a vertical position and by so doing the platform *H* is raised to support the reeds while they are filed at the tip or the heel as the case may be. It was possible to get the milling of the reeds so accurate that only 50 per cent needed tuning. To complete the mouth organ it only remained for the parts to be assembled with three brass screws and nuts.

Cut the Force or Reduce Working Hours?

BY A. W. FORBES

It is often recommended that we should reduce hours instead of reducing the number of employees in times like the present so as to give a small amount of work to a large number. This would have the additional advantage of keeping together the organization so as to be ready for the coming rush of work.

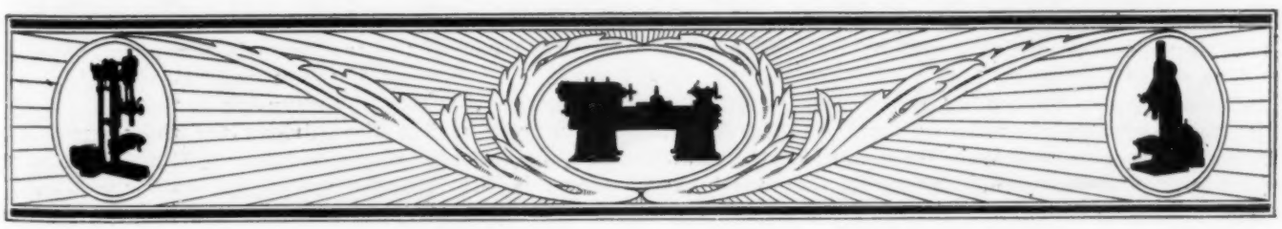
This sounds very good, and if conditions could be adjusted to make it practical I believe it would be the best way, but it has not worked out that way with me. As business started to slow down I had a number of workmen, all of whom were desirable employees. Some were advancing in their work and promised to be more valuable in the next time of plenty than they were last. There were others for whom I could see no future with me. They were doing their work satisfactorily, but that was all. If I should keep them over the lean years they would probably change about the time that they were needed, and that would be best for them as I should consider them as misfits in my shop.

Under these circumstances I kept all those whom I desired to start business with, and found that I was able to keep them all on full time. I hope the others will find better jobs for some of them are capable of filling them.

FEWER APPLICANTS FOR POSITIONS THAN DURING WAR TIME

Most of us expect business to improve soon, and I am looking around for persons to put on my waiting list. I have a few names on the list now, and every one has a good job now at full time, but they have expressed a preference for the kind of work that I offer, over the job they are holding. We hear a lot now about the people who are out of work, but why don't they apply for work. I have not received half the applications that I did a year ago, and there are even less than during war time. To be sure I do not want anyone today, may not need anyone this year, but on the other hand I might want to double the force next week, as I have orders pending that if released would make this necessary. You would at least think that anyone out of work would go round to each of the shops in his home town and let them know what he could do. Yet I do not know of a single person who is out of work, and who has let me know of this fact within the last three months, whom I should want to employ when men are needed.

It would seem strange if it were necessary to hire away from another employer in times like these.



Machining the Peerless Upper Crankcase

The Sequence of Operations—Milling Fixtures Used—Drilling Fixtures on Track with Turn- and Transfer-Tables—Some of the Inspection Gages

BY FRED H. COLVIN
Editor, *American Machinist*

THE method of handling the upper or main crankcase in the shop of the Peerless Motor Car Co., comprises thirty operations in the following sequence:

Operation 1. Cut off tubes and lugs.
Operation 2. Rough mill bottom.
Operation 3. Rough mill right cylinder bolting face at both ends.
Operation 4. Rough mill left cylinder bolting face.
Operation 5. Finish mill bottom.
Operation 6. Finish mill both cylinder bolting faces.
Operation 7. Mill at apex.
Operation 8. Straddle mill water tube flanges.
Operation 9. Drill eleven holes.
Operation 10. Bore and ream distributor hole. Drill sixteen holes and tap four holes.
Operation 11. Drill thirty-seven holes and ream four holes.
Operation 12. Drill thirty-five holes.
Operation 13. Tap sixty-four holes.
Operation 14. Stud twelve holes.
Operation 15. Bolt crankshaft bearing caps to crankcase.
Operation 16. Bore and ream crankshaft and camshaft holes and face rear end of camshaft holes.
Operation 17. Drill and tap pipe hole at front end.
Operation 18. Straddle-mill center bearings.
Operation 19. Unbolt front and rear bearings for lathe operation. After this they are again bolted to face and upper half bolted to lower.
Operation 20. Bore and face rear end and face front end.
Operation 21. Drill twenty holes.
Operation 22. Drill twenty-four holes and ream two.
Operation 23. Tap forty-two holes.
Operation 24. Unbolt lower half.
Operation 25. Bore and face camshaft hole, bore and ream starter-motor housing hole.
Operation 26. Unbolt caps.
Operation 27. Spot face four motor arm holes.
Operation 28. Drill three dowel holes and four holes for oiling system.
Operation 29. Solder all sand and blow holes and file burrs.
Operation 30. Inspection.

The cutting off of the projections left by the foundry is done on a bandsaw. Then comes the rough milling of the bottom as shown in Fig. 1. The milling cutters in the vertical spindles face the bottom of the crankcase which is held upside down in the fixtures as shown. The side mills face the projecting arms which form the bearers that support front end of the motor on the frame of the chassis.

In milling the face to which cylinder castings are bolted, fixtures having surfaces at 45-deg. angle from the table are used as shown in Fig. 2. These fixtures hold the crankcase at the proper angle, locating them from the bottom surface previously milled. Both ends of the crankcase are also milled at this setting, milling cutters of large diameter being necessary in order to cover the entire surfaces of the end at one setting.

In finish milling the bottom, the crankcase is located on the cylinder bolting faces, which fit the V-shaped blocks shown in Fig. 3. The fixtures are so arranged as to readily clamp the casting firmly in place without distortion and so as to insure the finished surface being flat and true. It will be noted that the type of fixture is quite different from that used for the roughing cut in Fig. 1.

Locating from the finished bottom surface and using an indexing fixture, the cylinder bolting surfaces are finally finished with a light cut on the Brown & Sharpe vertical milling machines shown in Fig. 4. This view also shows the meeting line of the two cuts on the roughing operation, which is removed by a finishing cut.

The water flanges on each side that form the connections between the cooling system and the cylinders, are faced by straddle mills as shown in Fig. 5. The holding fixture is practically identical with that shown in Fig. 3, the work being done on a Cincinnati knee-type milling machine.

The drilling operations begin in Fig. 6, which includes four holes for the distributor and the two holes in each of the arms which support the motor in the frame. This view shows the construction of the fixture in which the crankcase is mounted on trunnions so as to be readily revolved to present different faces for drilling. It also shows how the fixture is mounted on four wheels which run on the track shown. At the left of the fixture is shown part of a transfer table *A* on which the fixture can either be rolled to the next machine in line or transferred, at right-angles to this track, to another track at the rear. The track is used while loading the fixtures so as to insure practically continuous operation of the machine and save losing time while castings are being put in or taken out of the fixtures.

The next drilling operation is shown in Fig. 7 in which the crankcase is turned on its side. Some of the tools used are shown on the stand at the right where they are kept conveniently near the work. This view also shows the transfer table *A* previously referred to, used as a bridge between the two machines.

Reversing Fixture on Turntable

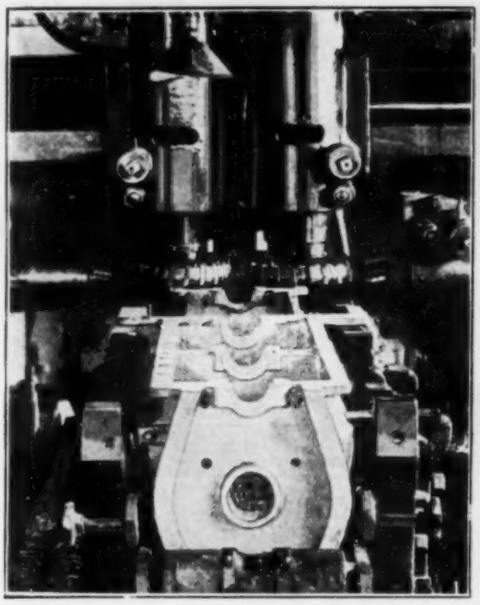
Still another drilling operation is illustrated in Fig. 8 and shows a turntable in the track line instead of the transfer table previously shown. The turntable is for moving the fixture and its work at right-angles or for reversing it as shown in Fig. 9. Here the crankcase is turned upside down for drilling the flange holes and to complete the drilling operations under the Baush multiple spindle drilling machine shown.

The beginning of the tapping operations, is shown in Fig. 10, which also gives an idea of the angle fixture on which the crankcase is held. The tapping is done on a large size Rickert & Shafer tapping machine with jointed arms which make it possible to move the tapping spindle readily from one position to another. The taps used are kept conveniently in a toolblock as shown, and the gages are also shown on the table of the machine near this block.

After putting in the studs which hold the three bearing caps in place, the crankcase goes to the boring fixture shown in Fig. 11, being mounted on a Rockford horizontal drilling machine. The crankcase is supported by its angular faces and the boring bars are guided by suitable bushings so as to insure the correct center distances between the holes bored.

Then the center bearing is straddle milled, the bearing caps removed and the lower half of a machined crankcase is bolted in place so as to make a complete unit. The complete crankcase is swung on a suitable mandrel. The driver shown at *A* is bolted into position and the stud projects through it to the faceplate. The rear end of the crankcase is faced and bored to insure the centering of the transmission housing, and the front end is faced by reversing in the lathe.

The rear end is then drilled for the transmission housing under a Baush multiple drilling machine as shown in Fig. 13. No special fixture is used, only a drilling plate carrying bushings and properly located,



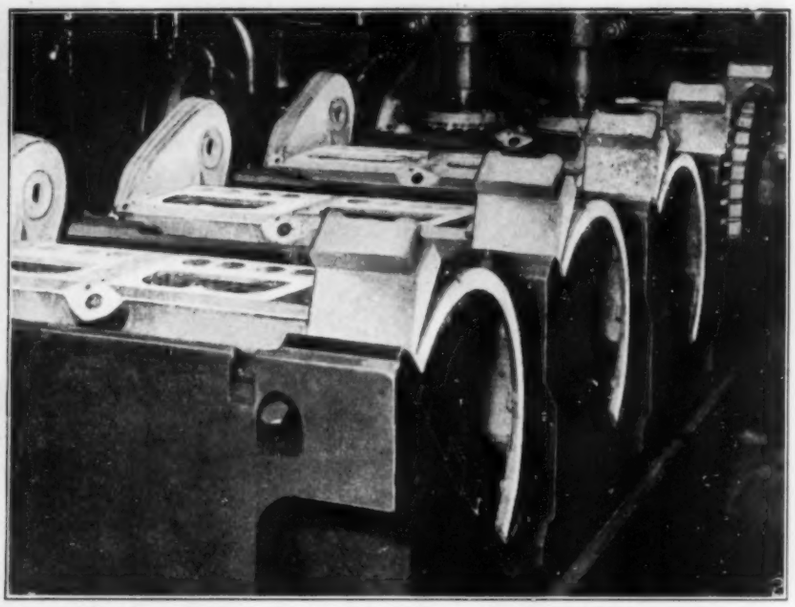
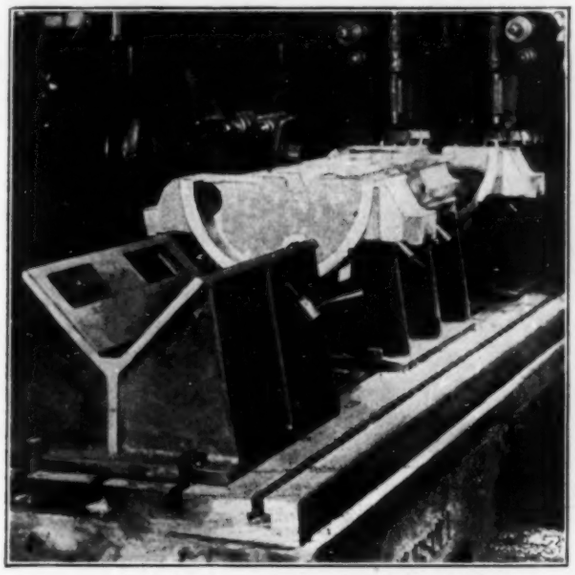


FIG. 1. ROUGH MILLING BOTTOM SURFACE. FIG. 2. ROUGH MILLING CYLINDER SEAT



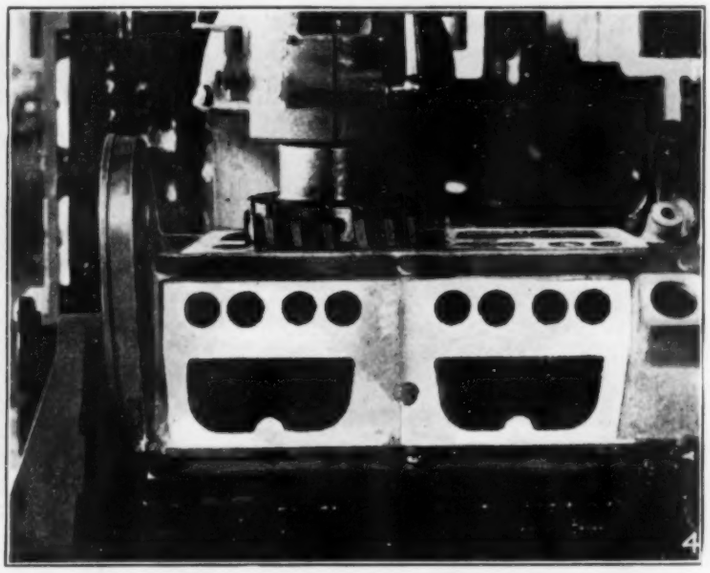
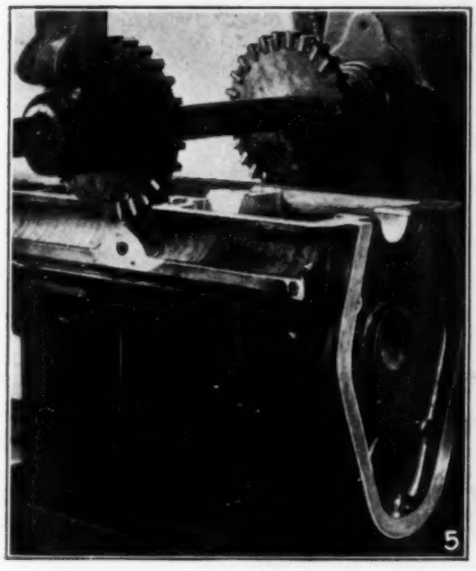


FIG. 3. FINISH MILLING BOTTOM SURFACE. FIG. 4. FINISH MILLING CYLINDER SEAT



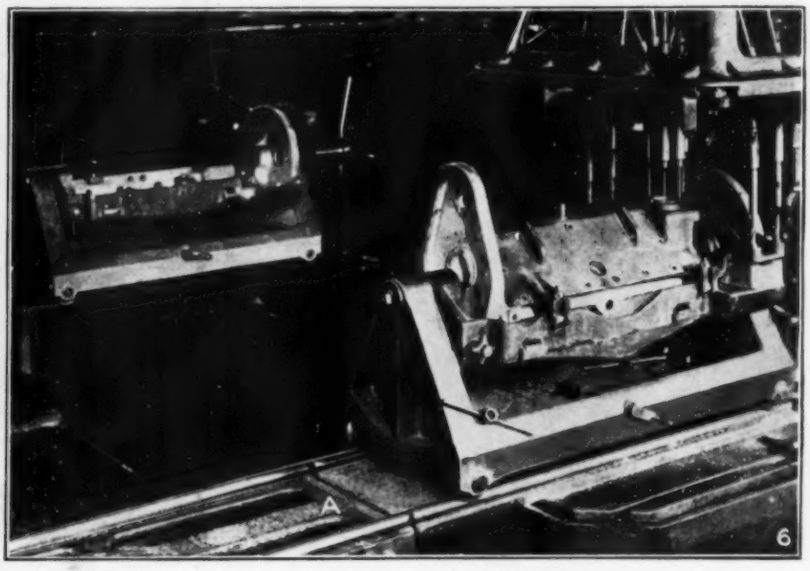


FIG. 5. MILLING WATER TUBE OPENING. FIG. 6. FIRST DRILLING OPERATION

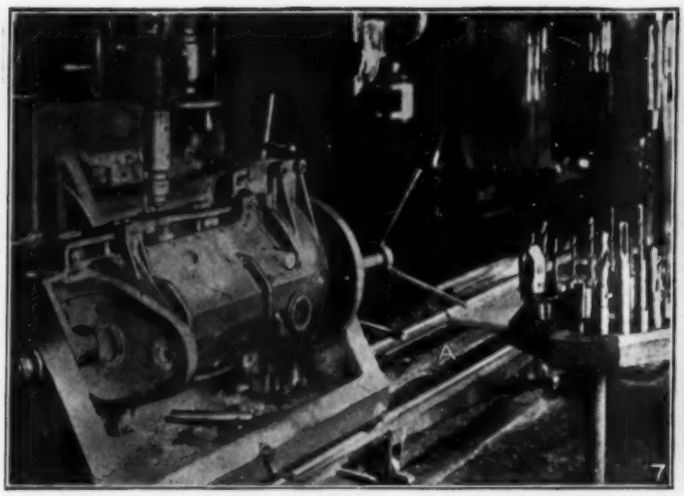


FIG. 7. ANOTHER POSITION ON DRILLING FIXTURE.

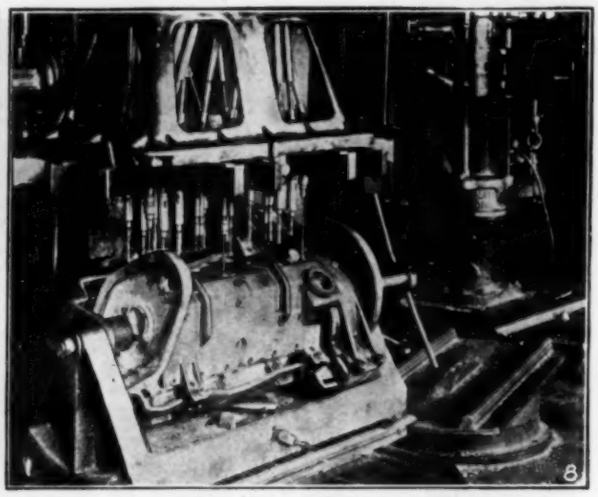


FIG. 8. TURN TABLE IN DRILLING TRACK

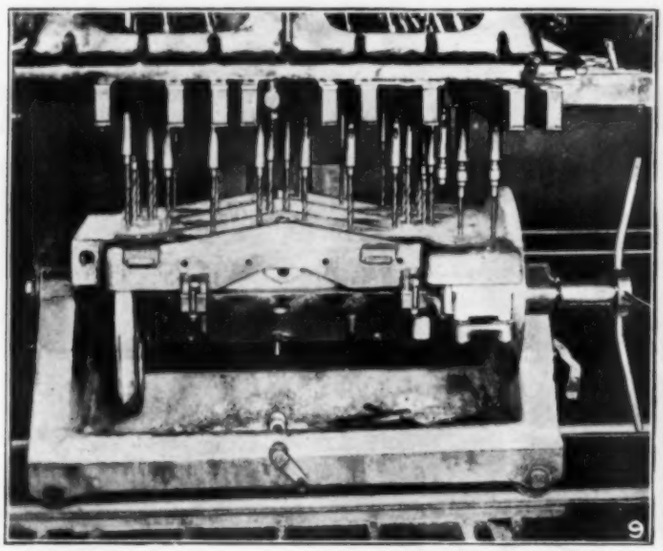


FIG. 9. DRILLING BOTTOM OF CRANKCASE.

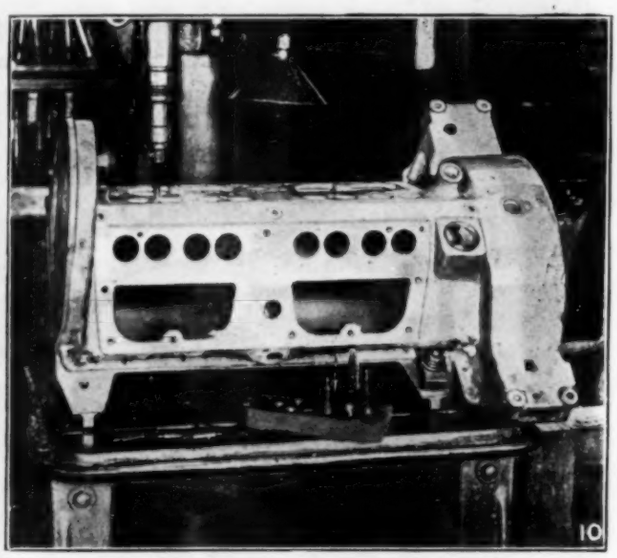


FIG. 10. ONE OF THE TAPPING FIXTURES

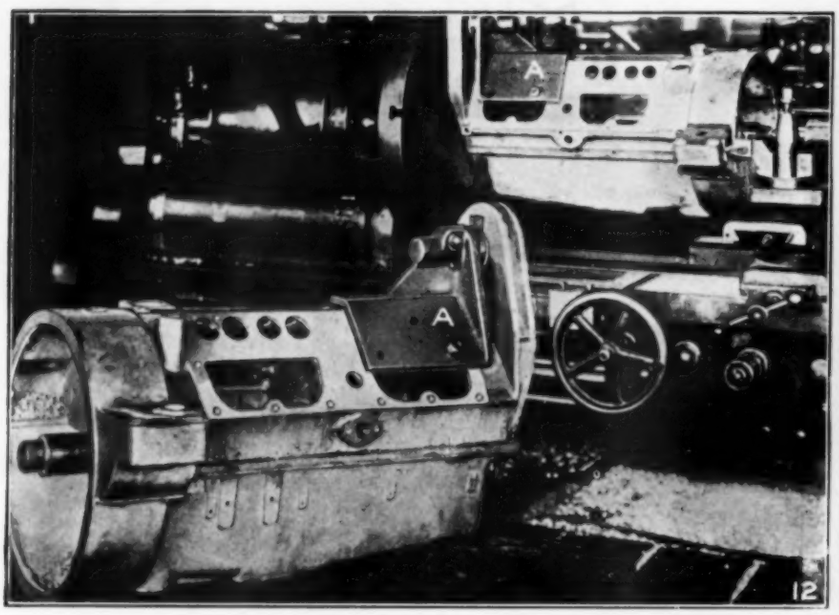


FIG. 12. BORING AND FACING ENDS.

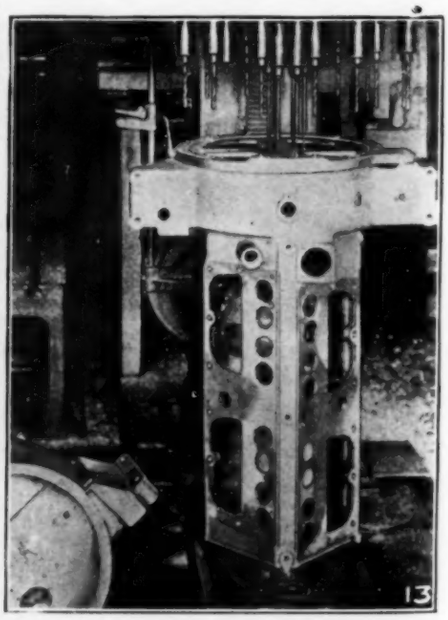


FIG. 13. DRILLING REAR END

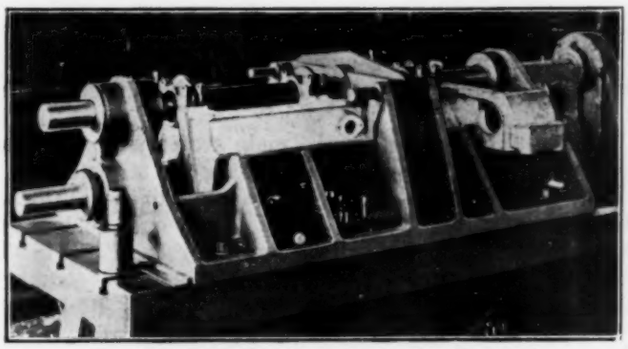


FIG. 11. BORING CRANKCASE BEARINGS

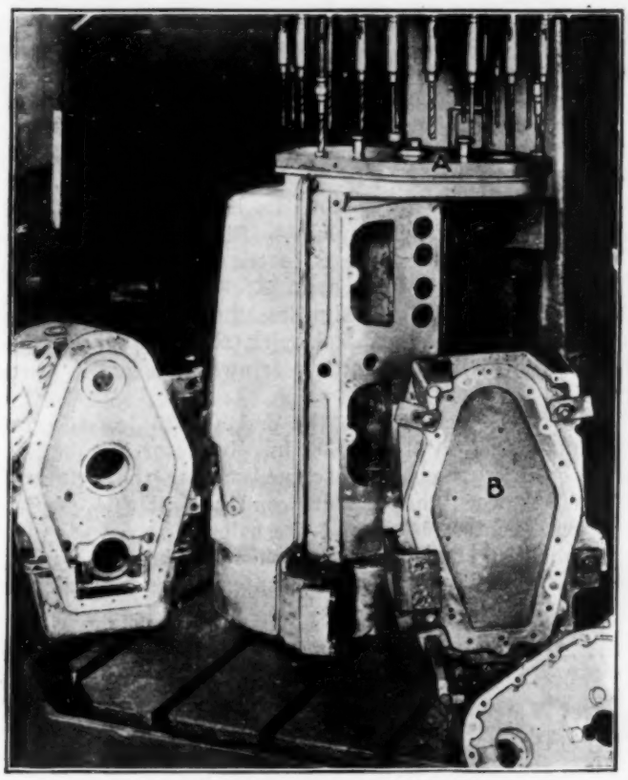


FIG. 14. DRILLING FOR FRONT COVER PLATE

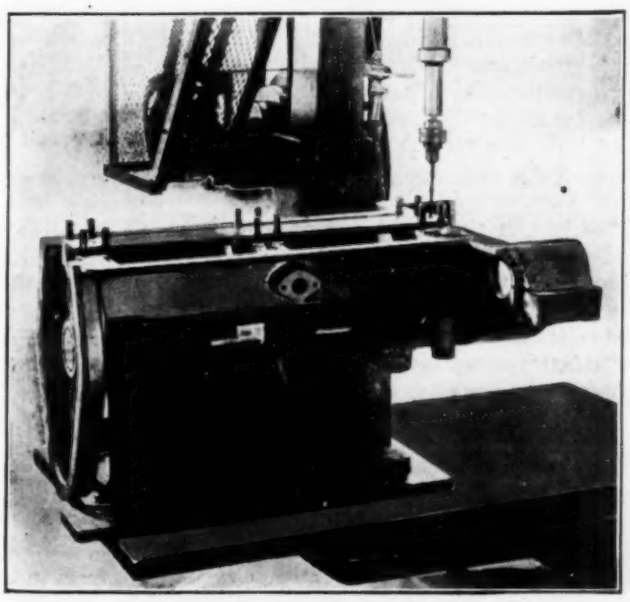


FIG. 17. THE FINAL DRILLING

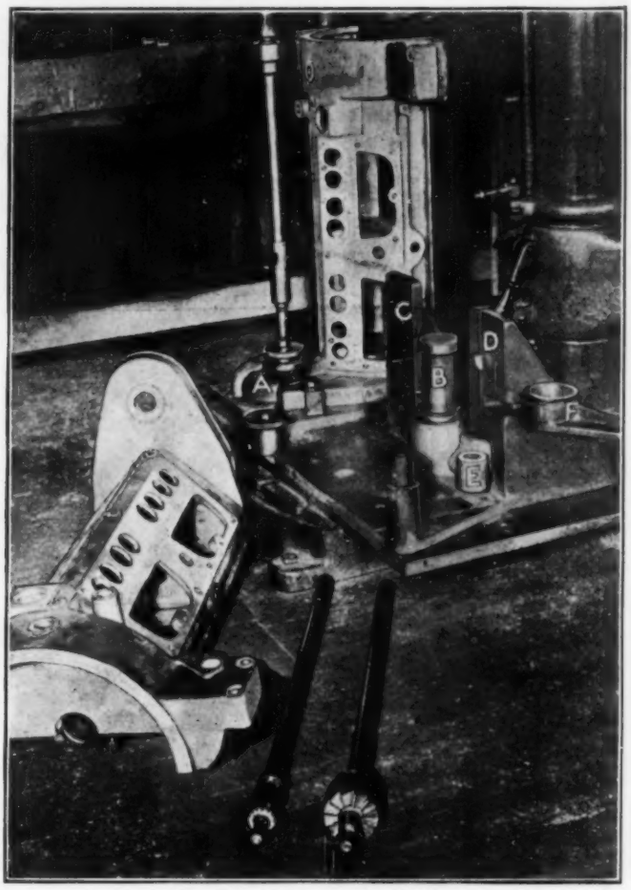


FIG. 15. BORING FOR CAMSHAFT HOLE

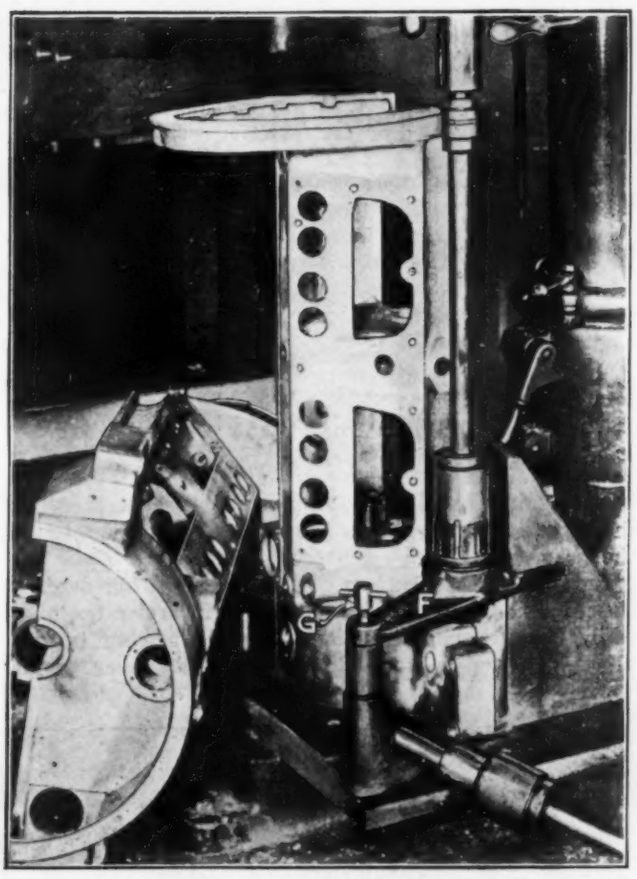


FIG. 16. REAMING STARTER MOTOR HOLE

being necessary. Another drilling operation covering the front end of the crankcase is shown in Fig. 14, both halves being bolted together in both operations. This view shows the plate *A* used for drilling the crank case and at *B*, the fixture used in drilling the cover.

Guiding Long Boring Bars

The two halves are then unbolted and the holes for both the camshaft and the starter-motor housing are bored and faced as shown in Fig. 15. The camshaft bushing is carried in the arm *F*. Fig. 16 shows this operation in progress, the arm *F* being swung into position and locked by the pin *G*, carrying the upper guide bushing.

The final machining on the main crankcase is shown in Fig. 17 and consists of drilling special oil holes and dowel holes in a V-shaped fixture similar to those which have already been shown. This leaves only soldering all sand and blow holes, filing off burrs and the final inspection to complete the main portion of the crankcase.

Two of the gages used are shown in Figs. 18 and 19. The gage in Fig. 18 is for checking the location of the bushing holes in the crankcase front end and consists of a plate having two handles *A* and *B*, and three bushings *C*, *D* and *E*, through which plugs *E*, *G* and *H* are inserted.

The gages for checking the relation between the location of the distributor hole and the crankshaft hole are a little unusual. The holes are shown at *A* and *B* in Fig. 19. The gages, Fig. 20 have been made to take care of variations up to 0.005 in. but the work is held to 0.001 in. limit. The plug *A*, Fig. 20, goes in hole *A*, Fig. 19, and the plug *B* in the corresponding hole in the crankcase. Plug gage *A*, Fig. 20, is a plain plug with a flange for sighting the tapped holes for the distributor. When making a thorough check the flange is held in place by two screws, to make it more rigid.

Plug *B* is eccentric on the end, 0.0025 in. on each side, making a total of 0.005 in. By inserting plug *B* in hole *B* of the crankcase, and noting the point of contact between the eccentric end and plug *A*, shows the exact center distance of the holes.

If the plugs make contact when the eccentric is at the center or zero point, the center distance would be

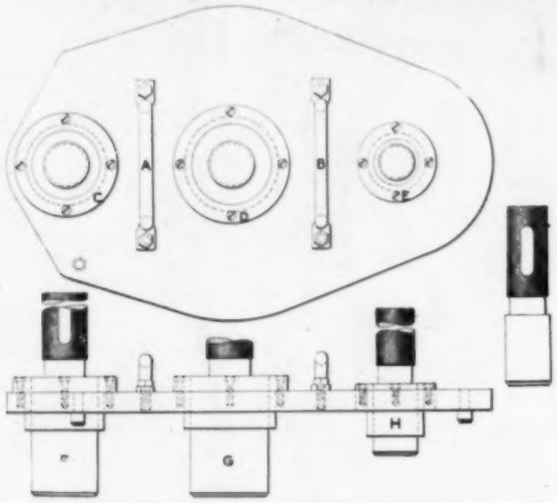


FIG. 18. GAGE FOR LOCATING HOLES IN FRONT END

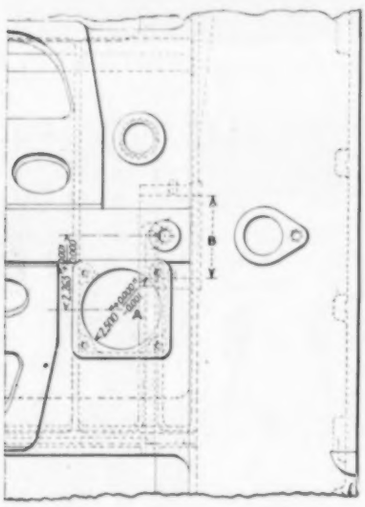


FIG. 19. CRANKCASE HOLES TO BE GAGED

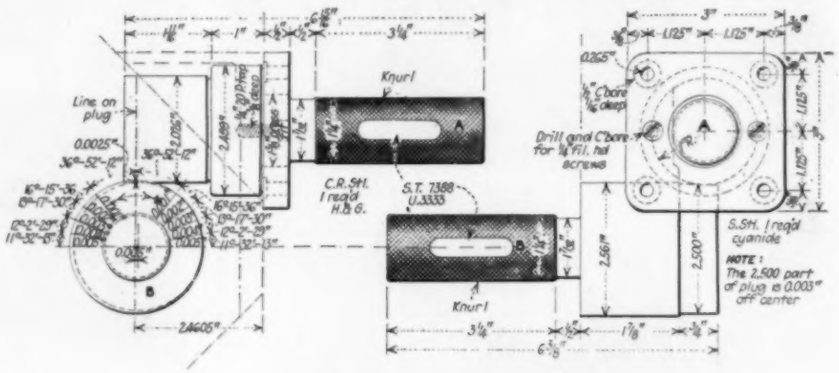


FIG. 20. GAGE FOR DISTRIBUTOR HOLES

hole is being bored at *A*, the curved bracket carrying the bushing which guides the drill. The other end of the crankcase is then centered on the stud *B* by its main bearing, the bottom of the case locating against the upright *C* and *D*. The bushing *E* carries the pilot of both the boring and facing bars, insuring correct alignment and center distances. The upper guide

2.263 in. If the plug turns to the left to the first line, the distance is 2.264 in. each division reading 0.001 in. Should the distance be less than 2.263 in. the plug will turn to the right, this giving the *minus*, while the left gives the *plus* reading. This has proved to be a very satisfactory method of determining the distance of these right-angled holes.

The Economics of Production

III. COSTS AND PRICE AND PRODUCTION

By Prof. D. A. McCabe, Ph. D.

IT IS a very common belief that costs of production govern prices. It is taken for granted by many that if costs rise prices will have to rise, and that prices cannot fall unless costs have been reduced.

Costs undoubtedly exercise an influence on prices, but the connection is not so simple as one of absolute control. It is important that we understand clearly just what the relation is between costs and prices. It is particularly important that we do not hold to the notion that cost alone controls price, that cost is an independent boss whose word must be obeyed without delay and without grumbling by price. Men who fall into that way of thinking are likely to get a bit careless about cost, in the easy belief that the price will carry off the cost without any disturbance.

Costs exercise an influence on prices, but the connection is not so simple as one of absolute control

The costs that affect prices most are the costs of new or current production, not the costs that have been incurred for the goods already made.

A producer's costs are largely determined inside his plant. They are affected very materially by the degree of efficiency with which the materials are converted into the finished commodity.

We need go no further back than the cost-plus contracts of the war for an illustration of this. It was a simple matter to get labor and materials away from the other manufacturer by paying more for them when the increased cost went automatically into the bill. It was easy also to overlook mounting costs in other lines where they took care of themselves in the same accomodating fashion.

To go back a bit, we have already seen that demand has an important influence on price. To take an extreme case, we may say that without demand there would be no price—that is, no price at which the goods would be actually sold. To take a more practical case, we should say that *the demand fixes the price for any particular quantity.* Therefore if cost is also to affect price, it must affect it through *affecting the quantity offered.*

If the demand for a particular kind of motor is for 10,000 at $50, or 9,000 at $55, and if 10,000 motors are offered at $50, the price will be $50. If, however, only 9,000 are offered, the price will be $55. Whether the motors will be offered at $50 or at $55 in sufficient quantity to meet the demand at either of these possible prices, will depend largely on the cost of producing them. A difference of $5 in the cost of production may make the difference between a price of $55 and a price of $50. But it makes that difference in price only through making a difference of 1,000 in the number of motors sold.

If, now, the cost of producing the motors should be raised to $75, would the price too be raised to $80, or even to $75? We are assuming, of course, that the demand has remained unchanged. Under these circumstances the producers might raise the price, but if they did they could not expect to sell the old number of motors. It is easy to see that the price *must* go above $75 if they are to make any money, but how much money will they make if they get $80 apiece and sell only 5,000 motors? Costs do affect prices, yes, but for increases in price to cover increased costs the producers have to pay the penalty of reduced sales, if the demand remains unchanged. The producers cannot raise the price and sell the same quantity, costs or no costs.

A second point that we must bear in mind in this connection is that *the costs that affect prices most are the costs of new or current production, not the costs that have been incurred for the goods already made.* It is the adjustment of the amounts offered at particular prices to the amounts demanded at those prices that produces the actual price at which trading takes place. *The prices at which goods are offered do not necessarily depend upon what it cost to produce those goods, but upon what it is likely to cost to produce other goods of the same kind to meet the expected demand.*

If, for example, the cost of producing the motors in the above illustration advanced $5, the motors produced at the old costs in the expectation of a price of $50 would probably not be offered at $50, but would be held for the higher price that the *new* costs seem to make necessary for the future. On the other hand, motors that it cost more than $45 to make would have to be sold for $45 if a drop in costs occurred and new motors were already coming on the market at $45 with a profit to their makers.

A change in demand would also affect prices in the same way, regardless of the costs already incurred. An increase in demand results in a price increase on the goods in the stockroom. A decrease in demand forces the sale of finished goods at less than the expected price, and often at less than it cost to make them.

A third important point in the relation between cost of production and price and the quantity produced is that *it is not any one producer's costs that makes the relation between cost and price* in the ordinary case. If a producer is making a patented article for which there is no good substitute close to his price, he is concerned only with his own costs, within reasonable limits. But if he is competing with others who are producing the same article, or articles of the same kind under different trade marks, the situation is quite different. No matter what his own costs are, the price at which he can sell is limited by what the other producers can continue to sell their articles for at a profit that induces them to

continue in the competition. This leaves out of account the fact that he may at times have to meet prices quoted by them that do not return them their costs. The point of permanent bearing here is that the price which covers their costs and a sufficient margin to keep them producing their quantities is the price which he must meet if he is going to sell on price in competition with them.

The final point to be emphasized in this article is that costs are not merely a matter of prices or rates of wages. Where there is competition for materials and labor, the producers have to pay about the same prices and the same rates of wages. These prices and rates are determined by the various demands for the available materials and labor for the production of goods—not goods of the same kind only but goods of different kinds. A manufacturer of looms will probably have to pay about the same price for coal as a shoe manufacturer in the same district. He will also have to pay about the same daily rate for machinists as the manufacturer of automobiles in his neighborhood. The prices of material and rates of wages which he has to pay are largely determined by forces outside his plant.

But beyond this a producer's costs are largely determined *inside* his plant. They are affected very materially by the degree of efficiency with which the materials are converted into the finished commodity. And this efficiency affects to a very important degree the volume of production of that plant. The demand being what it is, the costs affect the quantity that the plant can sell, even if it has no competition. Where it has competition, the costs affect not only how much it can sell, but whether it can continue in that business.

In the next article we shall consider the causes of changes in demand and the readjustments in the volume of production and in costs which these changes make necessary.

The Selection of Apprentices—Discussion

By A. W. Forbes

In F. P. Adelbert's article under the above title on page 84 of the *American Machinist*, he asks one question that needs an answer. He says, "Can Mr. Forbes honestly say that his shop, or any other that he has in mind, would give an equal foundation for advance or equal distinctions to a graduate of their apprentice course?" The comparison is with the college course. The answer Mr. Adelbert doubtless expects is no, but I am fully convinced that my shop, as well as several others that I know personally, give opportunities for a better foundation for advance in certain occupations than any college or school, perhaps not as broad a foundation, but one that is more thorough, and one that is really superior.

Among the occupations that my shop gives a good foundation for are electric motor designer, machine designer and manager in technical lines. I might also add research engineer, a field which the college does not attempt to touch till after graduation.

As for the results in actual practice, this is a difficult thing to determine, as comparisons are of no value unless care is taken to compare boys of equal natural ability, but what little evidence we have seems to show that apprentice boys have done better in business and manufacturing than the college graduates.

College Men and Captains of Industry

Roger Babson estimated a short time ago that but 15 per cent of the captains of industry were college graduates. Now it is evident to anyone with experience with boys that most of the boys of exceptional ability go to college. While this was not as true a generation ago as it is today, still, even making due allowance for this, it does not seem likely that the training that produced 85 per cent of the industrial leaders could be much inferior to that which only produced 15 per cent from the highly selected group of students. Personally, I am of the opinion that the college graduate has a poorer preparation for industry than the apprentice in most of our factories, and that if the college graduate is successful it is in spite of the college training, not because of it.

The college was organized to make ministers and professional men out of farmer boys, but it has come to be looked upon as a kind of magician's wand that prepares anyone for anything. This is largely the result of extensive advertising.

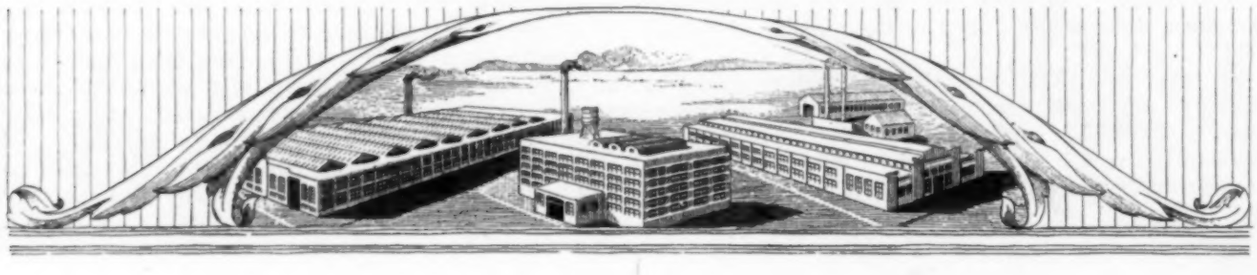
The colleges have improved a little since the day that our great men were educated, but the opportunity for the boys in the shop has increased tremendously. If 85 per cent of our leaders could have come to the highest positions without the aid of the college under the old conditions, it would be much easier for them to do so today, if we could only get boys of equal caliber to try it; but we cannot get the boys as long as the colleges advertise so effectively while the shops take anyone the colleges do not want.

Many apprentices, as well as the boys in our trade schools, are deserving boys, who will make good citizens in the capacity of machinists, patternmakers and other respectable trades, but few of them would be accepted by the colleges, as they have not the capacity to advance to the higher positions regardless of anything in the shape of education or opportunities that may be offered.

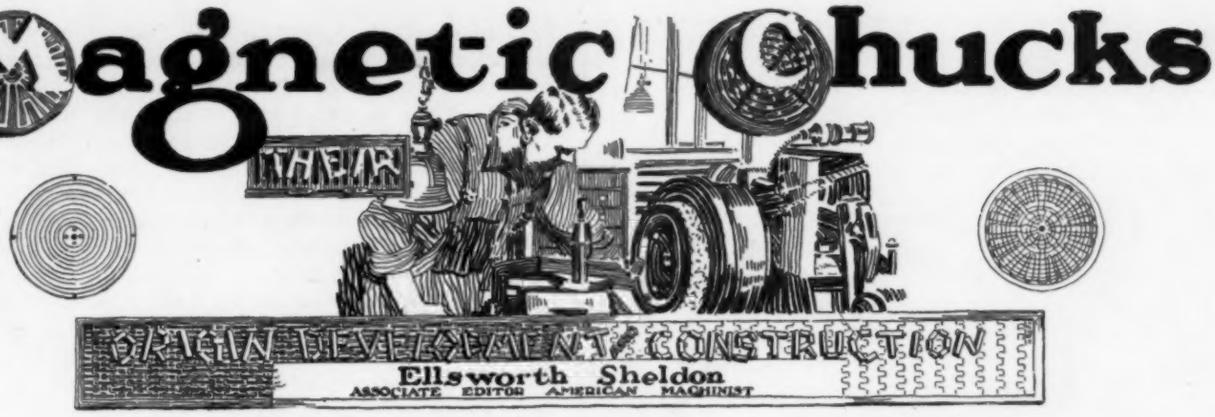
Planer Kinks in a Small Shop

By John P. Wheeler

I saw the following scheme in a small shop for a quick job in removing straps on planer and miller beds. The nuts were about twice as long as usual and, after tapping, had a clearance hole put through at an angle—about 30 deg. at a rough guess. The nut could be slid down onto the straps then tilted back square and tightened up. I thought the threads would strip easily, but was informed they last about as long as ordinary nuts and, of course, they escaped a lot of wear.



Magnetic Chucks



IX. Supporting Pieces of Irregular Shape on a Magnetic Chuck—Blocking Must Be Made to Match the Chuck—Testing a Chuck to Determine Its Class

UNTIL a very few years ago, the fact that a magnetic chuck would hold pieces of work of irregular shape almost as well as flat pieces, was not well-known. Even yet there are many toolmakers who, having a piece of work with perhaps a projection or a shoulder upon its otherwise flat surface that prevents

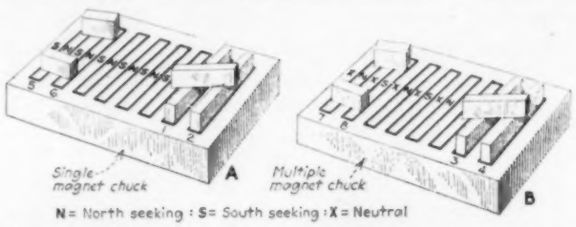


FIG. 1. SHOWING THE DIFFERENCE IN THE WAY IN WHICH HOLDING POWER IS EXERTED IN SINGLE MAGNET AND MULTIPLE MAGNET CHUCKS

it from resting squarely on the chuck, will discard the latter as a holding proposition and waste a deal of time in doing with bolts and straps what the chuck would do much better if it were only given the chance.

Many have tried to hold work having what we call a "two plane" surface, by supporting it on two parallels of different heights to match the surface; and, because it would not hold, condemned the chuck. Others have tried practically the same thing, and, finding that it *would* hold, criticized their brother's lack of knowledge for affirming to the contrary.

Neither were right. A chuck is perfectly capable of holding a piece of magnetic material of irregular shape at almost any reasonable distance from its surface provided the magnetic flux, or lines of force, can be properly transmitted from the chuck to the work, but unless the characteristics of the chuck are known, the principles of magnetism understood and the supporting pieces placed with due regard for its limitations, the experimenter is likely to be disappointed.

Ordinary Parallels Will Not Hold

If a parallel be placed upon the surface of a magnetic chuck in such position that it comes in contact with two or more poles of opposed polarity, or two or more pairs of poles, the parallel will be held strongly but, unless the parallel is very thin, there will be little tendency for any pieces of magnetic material to cling to it, and two parallels will be not one whit better than one; but if two parallels be so placed that one touches *only poles of north seeking polarity* and the other touches *only poles of south seeking polarity*, the parallels themselves will be but lightly held until a single piece of magnetic material is placed across the top of *both* parallels, when work and parallels will be rigidly bound together and held almost as firmly as a single piece.

The difference between the experience of the man who says a piece may be thus supported away from the surface of the chuck and yet held strongly, and that of the man who says that it will not hold at all under these conditions, is simply that the former puts his supporting pieces in the right place and the other does not.

The confusion in this respect is not lessened by the fact that chucks having decidedly different characteristics sometimes have a very similar appearance. One of the skeptical brethren may witness a demonstration and become convinced that he is wrong; the chuck will hold by this method. He then goes to his own shop, builds up a similar cob-house on his own chuck, turns on the current, and finds that what he knows isn't so; the work is not held at all. He has merely failed to take into consideration the characteristics of his chuck.

There need of necessity be little difference in external appearance between a single magnet chuck and

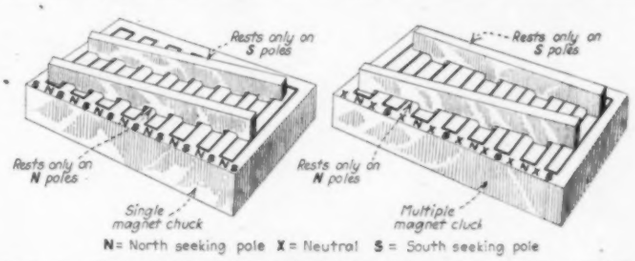

Rests only on S poles
Rests only on N poles
Single magnet chuck
Rests only on S poles
Rests only on N poles
Multiple magnet chuck
N= North seeking pole X = Neutral S = South seeking pole

FIG. 2. SHOWING HOW PARALLELS MUST BE CUT AWAY ON THE UNDER SURFACE IN ORDER TO TAKE ADVANTAGE OF THE CHARACTERISTICS OF EITHER TYPE OF CHUCK

one with a multiple magnet; in fact some makers have made both, the top plates of which were identical so far as a casual observation would disclose. In Fig. 1 may be seen a sketch of two top plates, one of a single and the other of a multiple magnet chuck. There is no visible difference between them, but magnetically they are quite opposed. If we were to lay a couple of small parallels on the chuck *A* in such manner that one parallel rested entirely within the rectangular pole face marked 1, and the other entirely within the pole face marked 2, we would find that upon laying a third paral-

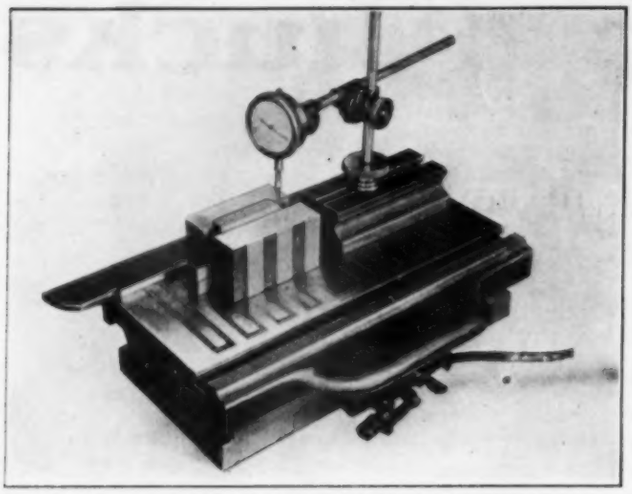


FIG. 3. A PRACTICAL APPLICATION OF THE CUT-AWAY PARALLELS

lel across the two that it would be held very lightly. On the other hand, if two parallels were similarly placed upon pole faces 3 and 4 of chuck *B*, while of themselves they would be held no more strongly than in the previous case, yet, when a third parallel was laid across the top of the pair, all three pieces would be held with practically the full power of the chuck.

Blocking Must Be Correctly Disposed with Reference to Polepieces

Two parallels, or one parallel, placed across the pole faces 5 and 6 or across the pole faces 7 and 8, would be held very strongly. If each chuck were properly calculated for current carrying capacity, magnetic section, etc., there would be little if any difference in the strength of pull. A third parallel placed across this pair would not be held *at all* in either case unless the underlying pair were of so small sectional area that they would not carry all of the magnetic flux.

From this illustration it may quickly be reasoned out that if a pair of parallels were made with one surface so cut away that one of the pair would bear entirely upon north seeking poles and its mate entirely upon south seeking poles we would have a new holding surface practically as good as the top plate of the chuck and raised above it by the thickness of the pieces.

This is precisely the case. Further than this, the parallels need not be of the same height, nor indeed, need they be parallels at all; they may be of any shape

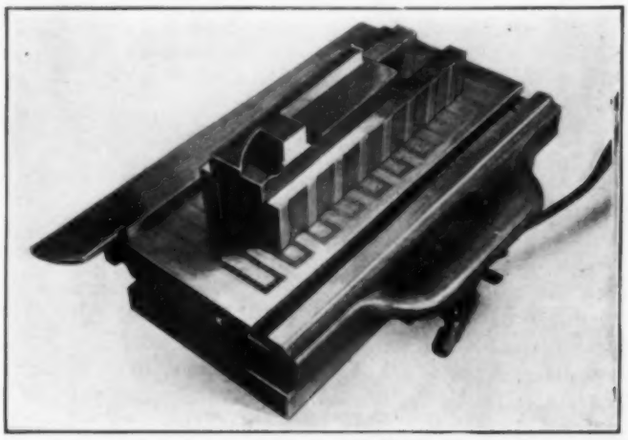


FIG. 4. HOLDING A PUNCH BY THE SHOULDERS ON PARALLELS

or size required so long as they fulfill the two fundamental conditions—they must be of magnetic material, and neither must touch more than one *kind* of pole. Their object is two-fold; mechanically to furnish a support for the work and magnetically, to provide a metallic path through which the lines of force may flow to and from the work and thus complete their necessary circuit through the magnets.

Instead of the parallels shown in Fig. 2, with their under surfaces cut away to avoid contact with every other pole let us consider the poles of the chuck to be covered with short blocks or cubes of metal, each cube carefully placed so as to rest squarely upon a pole face but not to span any of the soft metal divisions in such manner as to come in contact with two opposed poles. We may have a piece of work that is very irregular in shape and yet if each block is carefully fitted to just the right height to take its share of the weight of the work, the latter will be held with all the power of which the chuck is capable.

Composite Blocks or Parallels

Now if we are to grind or otherwise machine a number of duplicate pieces we would want to locate our blocks of metal with some degree of permanency so that they would not become jostled out of place when lifting and resetting work; therefore, we would drop

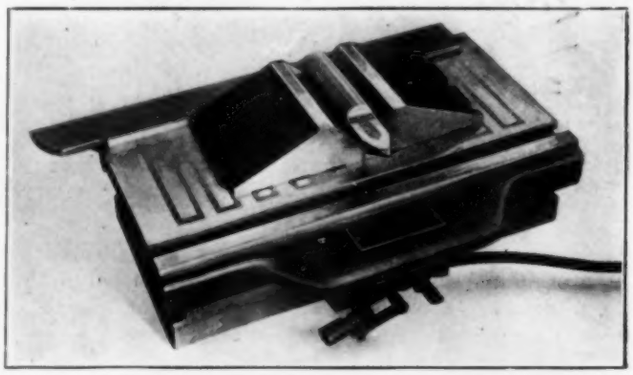


FIG. 5. A V-BLOCK TO BE USED IN CONNECTION WITH A MAGNETIC CHUCK

pieces of brass, wood, or other non-magnetic material between them, of suitable thickness to just fill the space. We might go further and drill one or more holes lengthwise of each group of blocks, put brass rods through them, and rivet over the ends. We could then machine the under face of our composite parallel to a true plane, the upper face to whatever shape was necessary to fit the work (though if the latter were irregular we could hardly call the composite piece a parallel) and we would then have a semi-permanent work support that would transmit practically all of the holding power of the chuck.

Such composite pieces have long been on the market, under the trade name of "radnetics"* though it is the writer's belief that they are not as well-known as their merit warrants. They are made in many shapes; even with concave upper surfaces fitted with a rocker of the same composite construction so that work may be tilted to any desired angle. The chuck manufacturers carry this principle a little farther and furnish auxiliary top plates, the construction of which corresponds exactly to

*These tools are now marketed under the trade name of "Karnetics" and are made by the Kar Engineering Co., 79 East 130th St., New York City.

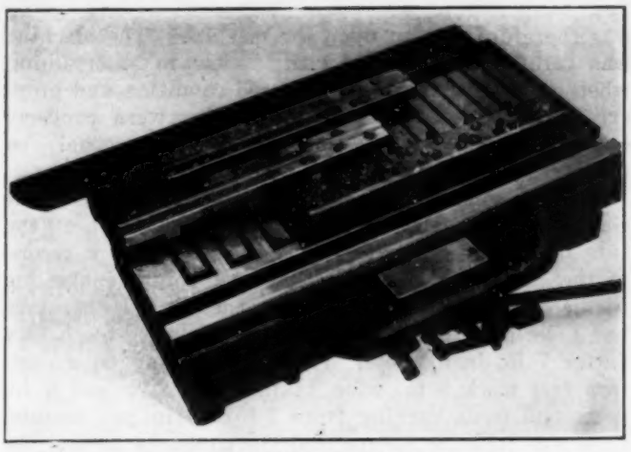


FIG. 6. PIECES TO HOLD THIN WORK ON THREE-POINT BEARINGS

that of the regular top plate. The auxiliary plates may have one surface machined with recesses, shoulders, or whatever is necessary to make them match the work; the under surface being left flat to make contact with the chuck face. These plates may be fastened to the chuck with screws if the latter is to be used constantly on one kind of work, as in manufacturing; but the fastening is not necessary, as with the current on and the work in place the auxiliary plate becomes rigidly a part of the chuck.

It is obvious from a study of the principles involved in Figs. 1 and 2, that such pieces, whether they be loosely made up, joined together as radnetics or made into a permanent plate, must match the chuck with which they are to be used; plates made for a single magnet chuck would be of no value whatever when placed upon a multiple magnet chuck, unless the patterns of the holding surfaces were *exactly alike*, which is not likely to happen.

If blocks, or short pieces, placed widthwise of the chuck, are used, the placing of the blocks so that each individual one rests upon but one pole face and does not touch its neighbor, automatically takes care of the distribution of magnetic flux so that no "short circuiting" takes place; but with radnetics or with the cut-away parallels shown in Fig. 2, it is necessary for the worker to know his chuck.

Fortunately, there is an appreciable difference in appearance between the standard chucks as made by the various manufacturers, and anyone who has followed this series of articles should be able at a glance to recognize the class in which nearly any chuck belongs; but, as has been stated before, this is not always safe. There are some multiple magnet chucks that so closely resemble in appearance the standard single magnet chuck that even their builders might well hesitate to place them without testing for polarity.

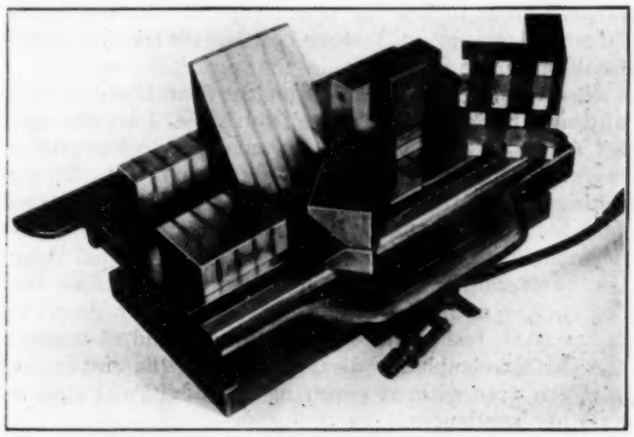


FIG. 7. OTHER COMPOSITE BLOCKING PIECES

Testing may be done with a compass. A compass, however, may easily be put out of business as an indicator of geographical north if brought into too intimate contact with a chuck, and a valuable one should not be used. By holding a short wire or rod of soft iron vertically with its lower end in contact with a pole face of the chuck, and bringing the compass near its upper end, the needle will instantly indicate its polarity. We do not care whether the compass indicates north or south but we must remember which one is indicated. Moving the wire across one divider on the chuck surface, if the chuck be a single magnet the compass needle will instantly swing the other way. If the compass responds indifferently or not at all, this second pole is probably neutral, but moving the wire across the *next* divider will show us with certainty; if the chuck is single magnet the compass will indicate the same polarity as in the first position, if multiple magnet, the opposite pole will be shown. Use a *soft* iron wire or rod for this purpose; a drill rod may retain sufficient magnetism to confuse the compass.

If No Compass Is Handy, Use a Sewing Needle

If no compass is handy a common sewing needle with 6 or 8 in. of thread makes a good indicator. Magnetize the needle by drawing its point against one pole face of the chuck. Now suspend it by the thread so that the point is ½ in. or so above the surface of the chuck and pass it slowly back and forth over the pole faces. Though the movement of the hand be steady the needle will move in a series of jumps; being strongly attracted by some poles and seeming to want to float over others. If the needle is attracted to every other division of the chuck surface, the chuck is single magnet; if it moves across in a series of long jumps, passing four soft metal dividing lines instead of two at each jump, the chuck is multiple magnet.

Though the independent magnet is, mechanically considered, a multiple magnet, its construction permits the doing away with the neutral surface between poles, and to this test it would appear as a single magnet chuck.

In Fig. 3 is shown a practical application of the parallels with the under surface partly cut away. The two short parallels are each cut away on two sides, so that they may be used flatwise, or on edge as shown. The cut-away surfaces are so calculated that one piece touches only north seeking poles and the other only the opposed poles. When they are used in the manner shown with a piece of magnetic material between them they are not only held down to the chuck, but are drawn together like the jaws of a vise. The two small taper parallels upon which the work is resting are of brass, otherwise they would interfere with the magnetic currents and weaken or destroy the grip of the parallels upon the work.

The block upon which the dial indicator shown in this illustration is mounted is of cast iron but its entire under surface is formed by a thick piece of brass fastened to the iron by brass screws, so that little or no magnetism reaches the indicator. The chuck is a Walker single magnet.

Another application is shown in Fig. 4. This is a very common job in any toolroom; the grinding of the cutting edges of a blanking punch, which must be supported by the shoulders of the punch with a clearance space for the shank. The punch is held in this manner quite as firmly as if the shoulders were resting directly upon the surface of the chuck.

In Fig. 5 is shown a V-block divided in the center by a strip of brass running transversely across it, and all parts are held together by brass bolts. The chuck is the same as previously shown—a Walker single magnet—and it may be noted that while one-half the V-block rests entirely upon the pole faces enclosed within the non-magnetic dividers, the other half rests only upon the bars of the grid; which in this chuck forms the other pole. This block will hold a square piece very well indeed, but its hold on a round piece is restricted by the fact that the circular outline of the piece will make but a narrow line contact with each side of the block. It holds, however, with sufficient firmness for light grinding cuts.

A set of pieces for holding very thin work is shown in Fig. 6. The pull of a magnetic chuck may by no means be ignored, for it is quite capable of deflecting by several thousandths any overhanging portion not over $\frac{1}{4}$ in. thick. The work for which these fixtures were made is square pieces somewhat thinner than this dimension and must be ground absolutely flat as far as the limitations of the grinding machine will permit. For this purpose it was desirable to support them on a three-point bearing to forestall the tendency of the pieces to rock.

The first fixtures made were of machinery steel with part of the bearing surface resting upon one set of poles and the other part upon opposed poles, but it was found that the machine-steel bodies became sufficiently magnetic to deflect the thin pieces of work even though the latter were separated from the body of the fixture by $\frac{1}{16}$ in. of space. The successful fixture is made of brass, with only the lower ends of the steel supporting pins resting upon the chuck.

A collection of holding devices including angle plates, V-blocks, triangles, etc., is shown in Fig. 7. These are all made to match the Walker single magnet chuck and would be of little or no use upon another kind. Similar tools, with their divisions so spaced as to match the divisions of the Heald, Simmons, D. & W., or other makes of chuck would, however, be equally serviceable in their respective places.

Chatter in Milling Machines

By P. V. Vernon

Referring to A. L. DeLeeuw's article on page 610, Vol. 54, of the *American Machinist* dealing with chatter, I venture to think that Mr. DeLeeuw has omitted one of the most common causes of chatter and a cause which appears to be unknown to a very large number of machine tool users. I allude to chatter caused by having the tools too sharp.

In 1912 I made several tests on one of our No. 16 vertical milling machines. In order to be quite sure that the tests would be reliable and not be affected by varying degrees of sharpness in the cutter, I had the cutter carefully watched and sharpened as soon as the slightest sign of bluntness began to appear. To my astonishment I found that on the majority of cuts the cutter chattered severely and considerable suspicion was therefore thrown upon the machine. The machine was carefully gone over with a view to ascertaining whether the bearings were in good condition and properly adjusted, and whether the slides were properly bedded and adjusted, but no defects could be discovered.

Feeling somewhat desperate I determined that as chatter was apparently a concomitant of most of the cuts taken, the only thing to do was to make a record of the chatter in the hope that such might enable me to discover the laws which governed it. I therefore had a series of cuts made, using an inserted-tooth face cutter 7 in. in diameter, 11 teeth, working on a cast-iron test block 5 in. wide, taking cuts $\frac{1}{8}$ in. and $\frac{1}{4}$ in. deep, and feeds varying from $\frac{3}{8}$ to $22\frac{1}{2}$ in. per minute. Care was taken to insure that the clearance behind the teeth of the cutter was not excessive.

A further but more limited series of tests was made on cuts $\frac{1}{8}$ in. deep using a 9-in. cutter, 12 teeth. Various cutting speeds were used, varying from 29 to 85 r.p.m. The results of the tests show that at $\frac{1}{8}$ in. deep the chatter began at 35 r.p.m. and became very bad at 69 r.p.m., becoming less at 85 r.p.m., and that the tendency to chatter became less as the rate of feed was increased, so that at the higher feeds there was no chatter at all.

The results of these tests were not sufficiently consistent to enable a law to be deduced, except that there was a general tendency for increase of feed to decrease chatter.

During these tests the cutter was not sharpened, as such did not appear to be necessary, and after the tests were completed, in order to be sure that no mistake had been made, I decided to repeat some of them using the same cutter, which was used exactly in the condition in which it happened to be, not quite sharp. To my surprise I found that no chatter was produced, and on repeating some of the cuts which, in the first set of tests had produced the worst chatter, I was unable to obtain any chatter at all. This put me on the scent, and I immediately made an expedition into our own milling department and interviewed the various operators, from whom I soon learned that a common practice with them when chatter existed was to slightly blunt the edges of the teeth by holding a free cutting oilstone against them while the cutter was revolving, and that this nearly always removed the chatter.

Although this practice had been in use for many years in our works it was a curious fact that it was apparently unknown outside the milling department, and so far as I know to this day is not generally known by the directing powers of factories although possibly quite familiar to the operators.

Having satisfied my mind on this point and storing up the experience gained for future use, I let the matter drop until a month or two ago I found a milling machine under test in our testing department. It was taking some fairly heavy cuts in steel and chattered very badly. Various attempts were being made in the department to overcome this by fitting additional steadies, but recalling my previous experience I asked that the cutters might be blunted in the manner described and a fresh test made. This was done and as a result the chatter completely disappeared and the cutters cut perfectly free without requiring any additional steadies or other appliances.

I think this aspect of the chattering of tools has not been previously published.

Cylinder Grinding in Motor Repair Shops

SPECIAL CORRESPONDENCE

(Continued from last week's issue.)

THE prices charged for regrinding vary in different sections of the country, as well as in some localities in the same sections. It is best to get several price lists from the nearest concerns doing business and charge according to the conditions in your particular city. Never cut below a fair price as regrinding is a quality proposition and it will cheapen your work and eventually be a losing proposition.

On the other hand remember you cannot make a fortune overnight. Excessive prices will only be an incentive for your customers to buy new blocks, to refinish by the boring method, or for new shops to start up.

Table I is an average of prices taken from several shops in each section. Those in the East, South, and the middle West include regrinding, fitting new pistons and rings. It does not include fitting pins to the pistons. Those in the far West include grinding cylinders, furnishing finished pistons, rings, and pins.

TABLE I—
AVERAGE PRICES IN DIFFERENT PARTS OF THE COUNTRY

Size	Cyl.	East	South	High Middle West	Low Middle West	Far West
Under 3 in.	2	$22.50	$24.00	$23.00	$17.00	$28.00
	4	43.00	41.50	45.00	34.00	42.00
	6	58.00	60.00	64.00	51.00	60.00
	8	74.00	77.00	83.00	66.00	76.00
	12	109.00	100.00	120.00	101.00	107.00
From 3 in. to 3½ in. dia.	2	22.50	27.00	24.00	18.00	32.00
	4	46.00	45.00	48.00	36.00	50.00
	6	59.00	64.00	68.00	53.00	71.00
	8	75.00	79.00	87.00	68.00	90.00
	12	114.00	.....	131.00	106.00	128.00
From 3½ in. to 4 in. dia.	2	24.50	29.00	28.00	23.00	36.00
	4	44.00	49.00	54.00	42.00	58.00
	6	66.00	70.00	76.00	63.00	81.00
	8	82.00	.....	104.00	85.00	104.00
From 4¼ in. to 4½ in. dia.	2	25.00	35.00	32.00	24.00	43.00
	4	50.00	55.00	60.00	46.00	69.00
	6	68.50	77.00	84.00	68.00	97.00
From 4¾ in. to 5 in. dia.	2	28.00	37.00	35.00	26.00	49.00
	4	53.00	62.00	67.00	50.00	79.00
	6	72.50	82.00	93.00	73.00	111.00
From 5¼ in. to 6 in. dia.	2	28.00	40.00	42.00	26.00	60.00
	4	55.00	66.00	78.00	50.00	93.00
	6	72.50	.....	130.00	73.00	136.00
		Prices without Pins				Prices with Pins

Prices on the Western coast and those on the Eastern coast are approximately the same. The prices for a complete job on the Western coast include fitting pins to the pistons. This is not done in any other section of the country. Therefore, while the price of a complete job on the Western coast is a little higher than in the East, for the amount of work that is done they are approximately the same.

In the South they are a little higher than in the East; in the middle West, cities like St. Louis, Chicago and Dayton are the highest to be found anywhere, while in Milwaukee, Indianapolis, and Cincinnati they are lower even than on the Western coast. These are local conditions and will have to be met with by each individual concern.

Production to be Secured

It has been found that, taking shops as a whole, under all conditions there is no reason why a good operator cannot average regrinding a hole every 30 minutes in a day's run. This would be very poor time in a manufacturing plant where the work is similar, as there they grind cylinders in from 6 to 10 minutes per hole. An experienced operator, even on miscellaneous work, should do better than half an hour, and does in many cases. As an example of what is possible, the following report is made by a Heald demonstrator:

"I ground the four holes of a Ford block, removing 0.010 in. stock, in 25 minutes from floor to floor. Used a 36-H precision wheel, 3 in. diameter, 1 in. face, and on the first time through removed 0.006 in. On the second pass I removed the other 0.004 in. and by letting the wheel go through the third time without feeding, the hole finished up nicely. I ground the four holes with one dressing of the wheel and worked to the dial graduation.

"These holes did not vary 0.0005 in. in size and were within 0.0003 in. of being round and straight. The work was done on a No. 55 machine."

This, of course, was exceptional time, but it shows what can be done. At the Trindl Company's shop in Chicago, on one machine that is running 24 hours a day, they are turning off 60 holes regularly in that time from Ford blocks.

The average wages paid regrinding operators vary with the locality. It is not profitable to have a poor operator, nor does it require an expert mechanic. It is well to pick out from the organization one man whom you wish to do this work all of the time and let him keep at it. He will gain proficiency not only in quality, but also in production. Some concerns put a premium on the work done. This has its advantages and disadvantages and should be determined by each local shop.

Save Time by Using Wheel Feed Dial

Many operators lose sight of the value and increased production that can be obtained by the proper use of the graduated dial on the wheel feeding device.

Having finished one hole to a size to which all the others will clean, take a reading of the graduated dial and turn back the feed about one-half a turn on this dial. This will put the wheel in position to enter the next hole to be ground, without danger of its touching the wall of the cylinder until you are ready to begin grinding.

The second hole can be ground approximately to the same size as the first without stopping to caliper, by simply feeding the wheel into the work until the dial is brought around to nearly the former reading. You will then have stock enough left for finishing. This device is a great convenience, for it saves stopping continually to caliper the hole at a considerable loss of time; and the new hole will always be smaller than the finished diameter until the former reading has been reached.

Amount of Stock to Remove

A cylinder grinding machine is a precision tool and cannot be expected to remove stock in big chips like a lathe, a planer, etc. On the other hand, it is built to remove stock very rapidly for a grinding operation and should not be considered a polishing proposition. With a little judgment and experience one will soon know just how much stock to take off in roughing out and also in finishing.

As an example, suppose there were 0.015 in. to remove. Be sure the wheel is trued up and then, using

TABLE II—WHEEL SELECTION FOR THE AVERAGE CYLINDER

Grade of Cast Iron	Abrasive Co.	American Co.	Carborundum Co.	Cortland Co.
Soft	30-J } Electrolon	36-J } Carbolite	365-P-OF } Carborundum	36-W Plus } Carbora
Medium	30-I }	36-I }	303-S-OH }	36-W 1 }
Hard	30-H }	36-I }	303-S-OH }	36-W 2 }
For Steel	46-J Borolon	7736-J Corundum	36-P-L6 Aloxite	36-K Oxaluma

Grade of Cast Iron	Detroit Co.	Norton Co.	Vitrified Co.	Waltham Co.
Soft	36-I } Staralon	36-I } Crystolon	46-H } Carbofied	46 s-I } Carbowalt
Medium	36-H }	36-H }	36-I }	36 s-I }
Hard	36-H }	36-H }	36-H }	36 s-H }
For Steel	36-I Staralox	3836-I Alundum	46-H Corundum	36 s-I SpecialAlowalt

the slowest speed of the table on the No. 55 and the medium speed on the No. 60 (referring to Heald machines) with the fastest speed of the eccentric on both machines, take out 0.004 in. on the first pass in, 0.002 in. coming out; 0.004 in. second pass in, 0.002 in. coming out; 0.002 in. third pass in, and 0.001 in. coming out. Let the wheel go in a fourth time with no feed at all. This will give in practically all cases a round, straight hole with a good commercial finish.

Selecting Wheels for the Work

A most vital factor for successful work is the wheel. Unless all conditions governing the wheels are of the best, results will not be satisfactory. Too hard a grade or grit of wheel will glaze or load, and the holes will not be round or straight; while, on the other hand, too soft a wheel will break down and wear away too fast.

Certain wheels seem to work very satisfactorily in practically all regrinding shops. Of course, different makes of cylinders vary, but taken as a whole, the best success in grinding cast iron is obtained with the wheels listed in Table II.

The wheels listed for hard cast iron are best for such castings as Mack, Pierce-Arrow, and Packard trucks. Their cylinders are extremely hard, in fact, are almost a semi-steel. Wheels for medium cast iron will handle 90 per cent of all regrinding jobs, taking them as they come.

Occasionally soft blocks are received that even the medium wheels do not cut freely, in which case be sure you are using the highest eccentric speed and use wheels listed under "soft." This hardly ever fails to give the desired results. Remember also that the finish can be only as good as the surface on the wheel and that it should be always perfectly true and smooth.

Steel cylinders sometimes find their way into regrinding shops, in which case be careful to use the wheels listed for steel.

Even if you have the correct wheel in regard to grade and grit, it will be useless unless it is up to speed. Wheels 2½ to 3 in. in diameter should run 6,950 r.p.m. These wheels will handle holes 2½ to 5½ in. in diameter. Wheels 3½ to 4 in. diameter should run 5,930 r.p.m., and can be used for holes 3 to 6½ in. diameter.

Wear on Wheels

There is sometimes a question as to the wear on a wheel when grinding. Taking the proper wheel on the average job, the wear on grinding 0.010 in. from four holes in one block will be so little that the holes will not vary 0.0005 in.

The actual wear on the wheel from grinding is hardly perceptible, most of it coming when the wheel is trued off.

In centering your wheel, be sure it is about half-way down the length of the hole. If you center at one end and the cylinder is badly out of round or not at right angles with the flange, when you get it to the other end it will be either cutting too much or too little. The hole can be best located by centering it with the wheel halfway along.

Vibration of the Wheel

If you are sure your bearings are up as snug as they should be with the machine running at proper speed and there is still a vibration in the wheel, possibly a firmer foundation for the entire machine will cure it. A cement foundation is recommended whenever possible, with the machine carefully lagged to it.

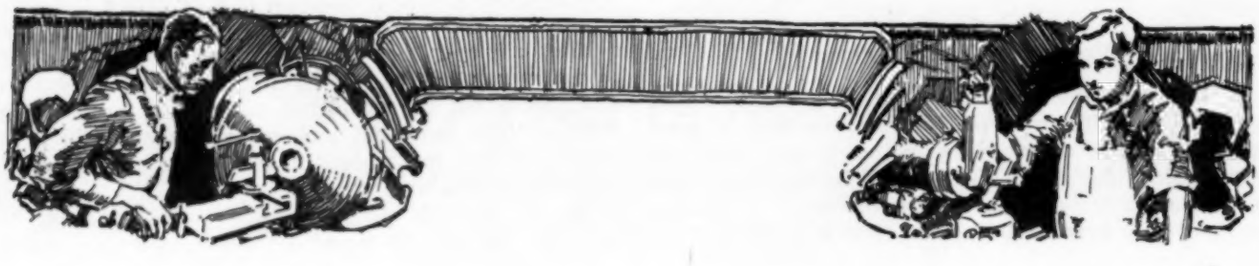
If the wheels are not of even thickness or are leaded, you will have vibration troubles. If they are not of even thickness, true off the sides of the wheel with a diamond; and for the second trouble, when buying new wheels specify them without lead bushings. These bushings quite often throw the wheel out of balance and heat up, causing the wheel to break more easily.

Occasionally internally ground surfaces have a wavy or chattered appearance. This does not in any manner affect the working of the motor. They sometimes appear more prominently on certain jobs than on others, due in a great measure to an improper wheel for that particular job.

If all bearings are carefully adjusted and the speed is right, a correctly selected wheel will practically eliminate them. They are immeasurable and have been found by laboratory test to entirely disappear with a lapping operation that did not remove more than 0.00025 in.

Dry grinding is used exclusively in regrinding shops. Water on the surface that is being ground will not give a good finish nor allow for satisfactory production. An exhaust fan can be furnished to carry away the dust.

Where large amounts of stock are to be removed, the cylinder becomes overheated, so that when cold the diameter of the hole is likely to change. It is best to rough out all the holes to within 0.002 in. of the finished size, and then by coming back to the first hole it will be nearly cool and ready for finished grinding. The usual custom when a nominal amount of stock is to be removed is to finish each hole as you go along.



Keller Automatic Die Sinking Machine

All Movements Electrically Controlled—Inexpensive Masters of Wood or Plaster Used—Tracer Bears Lightly on Master, While Cutter Works Under Pressure

SPECIAL CORRESPONDENCE

THE advent of the automobile, particularly the use of sheet metal automobile bodies, has made it necessary to make dies of increasingly large size. With the demand for larger stampings, the press manufacturers have developed presses capable of turning out work of a size undreamt of a short time ago.

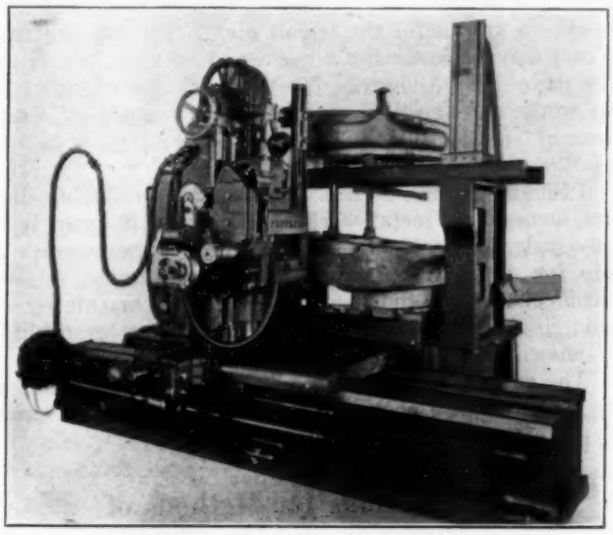


FIG. 1. KELLER AUTOMATIC DIE SINKING MACHINE

With the increase of the size of presses, making the dies for them became a serious problem. The machinery heretofore available for making such dies was dependent entirely on the skill of the operator and it was necessary to take the work from one machine to another. After all that could be done by them, the most particular part of the work had to be done by chipping, scraping and other hand methods.

The production of dies by such methods is very costly and it is practically impossible to calculate in advance with any degree of accuracy, either the time in which they can be finished or their ultimate cost.

The Keller Mechanical Engraving Co., Brooklyn, N. Y., has developed an addition to its line of die sinking machines which can be operated either automatically or semi-automatically, following a form or master and reproducing this form accurately in iron or steel. This machine is the result of long years of experience in the construction of automatic die sinking or profiling machines, and combines unusual cutting power with extreme accuracy in following and reproducing a pattern. It has the further advantage of working from a master which need not be of metal. Masters of cement, plaster or wood suffice. By an ingenious control of the tracing mechanism, the master is faithfully reproduced in all dimensions with only a slight pressure of the tracer against it. At the same time all the pressure necessary is applied to the cutting tool to carry a heavy cut with a substantial cutter.

A general view of the machine is shown in Fig. 1, where the master for an automobile fender is shown above the die being cut. Fig 2 is a close-up view of the upright carrying the cutting and tracing spindles as well as the push button control from which all feeds are electrically operated. All feeds are entirely automatic, and rapid traverse in every direction is provided. The setting-up is simple and the electrical control is capable of forcing the largest cutter suited to the work

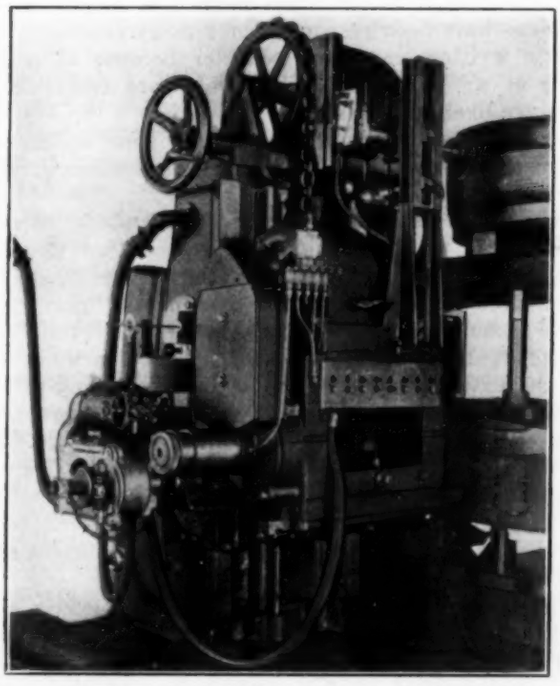


FIG. 2. OPERATING PART OF KELLER DIE SINKING MACHINE. FIG. 3. MACHINING A FENDER DIE

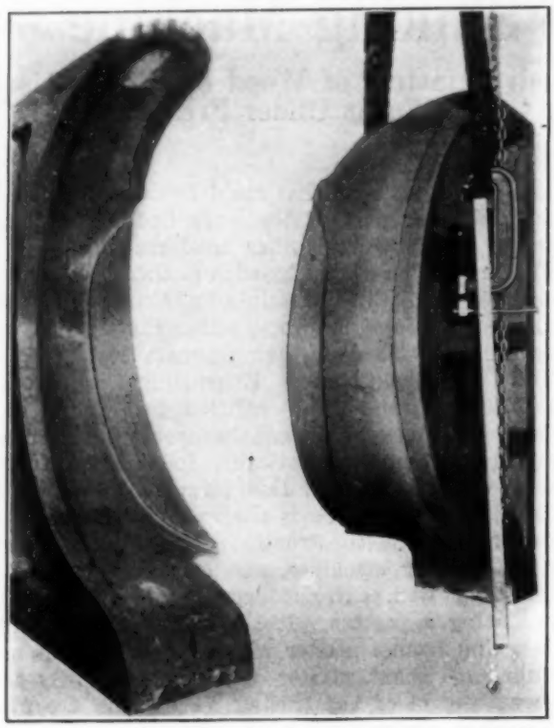


FIG. 4. A PAIR OF FENDER DIES JUST AS THEY LEFT THE MACHINE

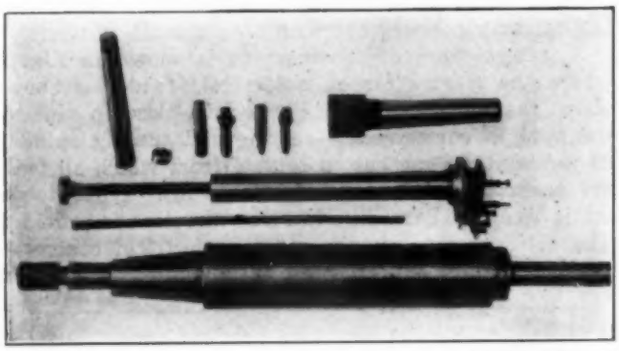


FIG. 6. CUTTER AND TRACER SPINDLES WITH CUTTERS AND TRACER POINTS

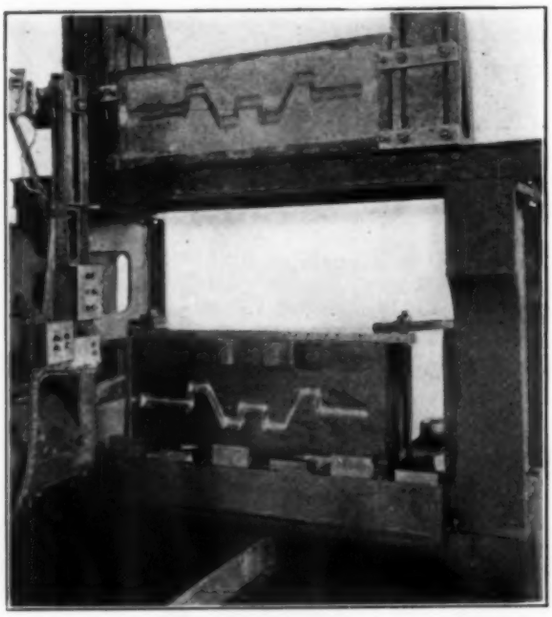


FIG. 5. MACHINING A CRANKSHAFT DIE

to the limit of its capacity without distress to the machine.

The entire machine is free from handwheels or cranks as every movement is controlled from a specific push button so that all physical exertion in operating the machine is eliminated.

The work leaves the machine in a condition requiring the minimum amount of hand work, as may be seen by the dies shown in Fig. 3. Fig. 4 shows a pair of fender dies after the machine work has been completed.

The original pattern is made of wood or plaster and from it a negative can be cast in cement or plaster and used as a master for the female die. From this negative a cast may be made for a master to be used in cutting the male die. Allowance for the thickness of metal to be worked in the dies can be made by applying sheet wax of the desired thickness to the first piece before casting the counterpart from it.

Though the use of this machine for producing dies for large sheet metal work has been dwelt upon, it is obviously applicable to dies for drop forge work. A die for a six throw crankshaft, for example, can be made entirely without any preparatory machining or even laying out. A die for a four throw crankshaft is shown in process in Fig. 5.

The cutter and tracer spindles are shown at *A* and *B* in Fig. 6, while above them are some of the different types of cutters and tracer points.

Suggestions for Methods of Dimensioning Drawings

BY MARTIN H. BALL

The chances of a recurrence of an event such as Alonzo G. Collins related on page 1022, Vol. 54, of the *American Machinist*, of a fly spoiling an expensive job, seems so remote that most of us will do nothing more than "swat the fly" with a little more determination and continue to make drawings as before.

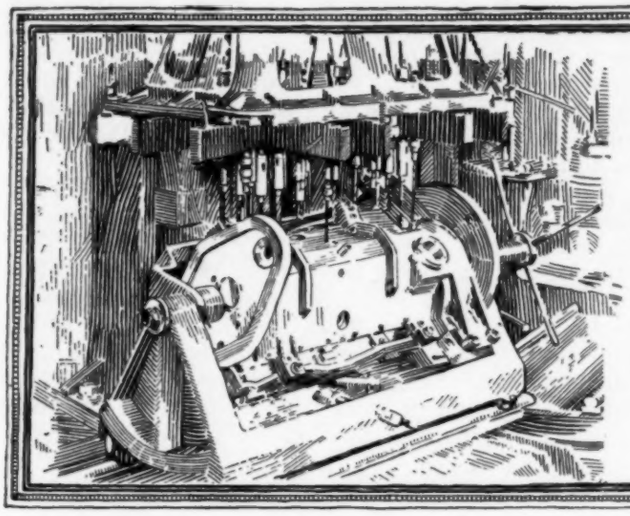
Dimension figures placed in the way shown by Mr. Collins—thus 3′ 8″, and this method is largely used I believe—have been responsible for many errors. When poorly written, carelessly read, or because of a dull, dirty or worn blueprint, all of which are avoidable, errors are likely to occur.

A better method which is used by some concerns is to use the abbreviation "ft." for all dimensions given in feet—thus 3 ft. 8″.

This mark can, if limited space demands it, be made quite small with safety for the reason that it cannot easily be mistaken for anything else. The mistakes that have been made by a wrong reading of figures, that have come under the writer's notice, have been most frequent in cutting up stock, when gages are not used to the extent that they are in succeeding operations.

Where dimensions are given with the abbreviation "ft." it is quite common for all dimensions under 24 in. to be given in inches. This gives more room for dimensions on a drawing of small scale, and I believe the limit of showing dimensions in this way could well be extended up to at least 37 in. and in some instances up to 49 in.; thus 48½″, 4 ft. 1″, etc.

Present-day practice seems to be to use longer measuring instruments than formerly and in the hands of the average user, inches seem to be less confusing than the combination of feet and inches in the lengths recommended above.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Albert A. Dowd Engineering Co., New York City

Broaches and Broaching Fixtures—Principles of Design—Tooth-Spacing and Chip-Clearance—Burnishing—Keyway Broaching—Multiple Fixtures—Index Broaching—Spiral Broaching

THE process of broaching is very old and dates back several hundred years when holes of various shapes were made in metal by forcing one or more tools of the required shape through the work by driving with a hammer or other means. Later on, short broaches with teeth were made and pushed

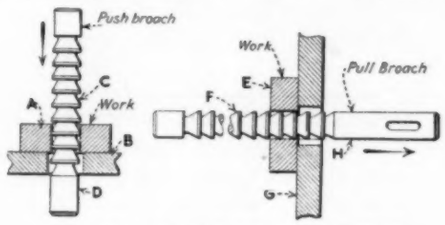


FIG. 186. TYPES OF BROACHING

through the work by means of hand presses or those operated by power. It was not until 1901, however, that the present process of pulling broaches through the work was developed. Before this time broaches were pushed through the work; now they are pulled through it in the majority of cases.

Push broaches are short while pull broaches are long and it is evident that the latter types possess distinct advantages over the former, in that a greater number of teeth can be used and as a consequence the cutting action is more uniform and sizes can be held much more easily. In addition to this, broaches that are pulled through the work do not tend to "run" or crowd to one side or the other, which fact is also a decided advantage. We must qualify this statement somewhat, because a dull broach will run out of alignment more or less. If the pull broach is sharp, however, it should run true if properly used.

There are a number of factors which influence the design and general construction of broaches and broaching fixtures. The tool engineer who attempts the design of tools of this sort must first familiarize himself with the important features and method of operating a broaching machine. There are several types on the market, the general features of which are more or less similar. Different methods of centralizing the broach in relation to the work are used, but other than this the construction is much the same in all types. In the horizontal types of machines, the work rests or is held by a fixture of some sort against a vertical faceplate through which the broach passes while in operation. Some types of broaching machines have only one spindle while others have two. In the two spindle variety one spindle is operating while the other is returning so that the lost time in setting up is reduced to a minimum.

Let us now consider the various points of importance in connection with the design of fixtures for broaching and also some pertinent matters regarding the broaches themselves:

(1) Material to be broached; as in other machining operations, the material to be broached is an important factor in determining what tools are best adapted for the work. So, in broaching, the material affects not only the design of the broach but the fixture that is to be used as well. The shape of the broach teeth and the amount of material that each tooth will have to remove are important factors which influence the production. (2) Thickness of the metal; this matter is of great importance in broaching operations as it affects the spacing of the broach teeth. It is difficult to cover the situation in a general note but detailed information will be given on the subject later on in this article.

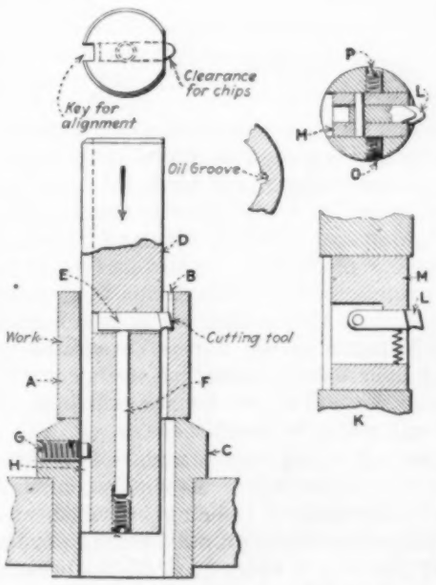


FIG. 187. SIMPLE BROACHING OPERATION

For authors' forthcoming book. All rights reserved.

(3) Production required; this matter must always be taken into consideration in designing a fixture as the cost of tools should be as nearly as possible in proportion to the amount of work that is to be produced. In broaching fixtures, this factor may easily affect the design of both broach and fixture and also determine the type of machine on which the work should be done.

(4) Preparation of work before broaching; unlike many other operations, work that is to be broached usually requires a certain amount of preliminary machining. A hole must be provided in which to insert the broach and a square surface should be provided on that side of the work which locates against the faceplate of the broaching machine. This point is of importance and, unless due consideration is given to it, may affect the accuracy of the work to an appreciable extent.

(5) Accuracy required; it is seldom that a broached hole is required within an accuracy greater than from

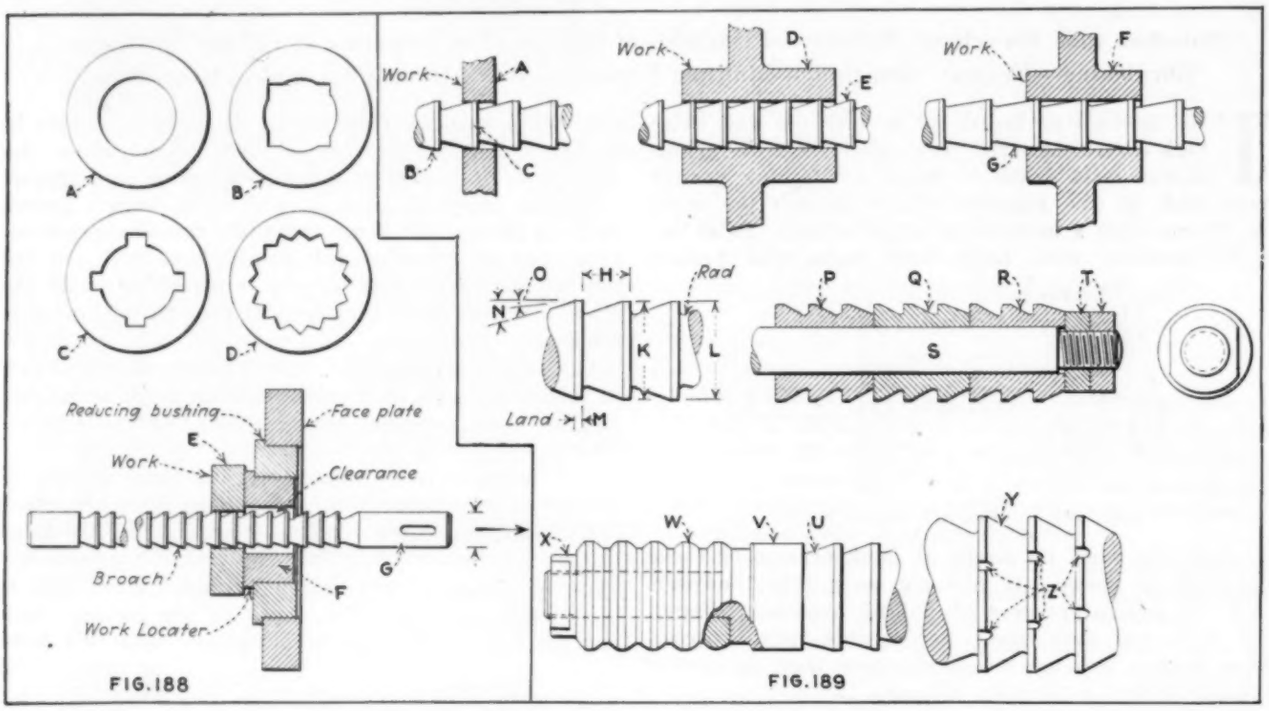


FIG. 188. EXAMPLES OF PLAIN BROACHING AND METHOD OF SETTING UP.
FIG. 189. PRINCIPAL POINTS IN BROACH DESIGN

0.001 to 0.002 in. and as it is not particularly difficult to keep within these limits it is evident that the broaching process can be applied to many kinds of work in general manufacturing. If very close tolerances are required both roughing and finishing cuts can be taken as in other machining processes. In some cases it is necessary to locate a broached hole in relation to another one which has been previously machined, in which case it may be found desirable to use the outboard sliding support with which broaching machines are provided in order to support the end of the broach and keep it in correct alignment while in operation.

(6) Lubrication; all broaching machines are provided with means of directing a stream of cutting lubricant into the hole while it is being broached, and this must be considered in making up a fixture in order that the lubricant may reach every part of the broach. For example, a square hole should be broached with a corner upward and not flat, so that the lubricant will reach all four sides of the broach and will not spatter off as it might otherwise. In broaching splined work, the channel between two of the splines should be at the top, so that it will retain the liquid and serve to carry it into the hole with the broach. The kind of lubricant used depends upon the material that is to be cut.

(7) Rigidity; it is highly important that all work that is to be broached should be supported properly in order to preclude the possibility of "chatter" or of the material springing away from the broach during the process, which would cause inaccuracies and tend to injure the broach. When several pieces are to be broached together or when the work is thin, particular attention must be given to the method of holding. Suitable supports or jacks must be provided for work which is irregular in shape in order to avoid any of the troubles mentioned.

(8) Clamping; various types of clamps have been described in previous articles so that it is only necessary to refer to some of these to cover practically all conditions of clamping such as may be required in broaching fixtures. Particular attention should be paid to any work which is thin or of irregular shape so that there will be no distortion due to improper methods of clamping.

(9) Cost of tools; usually the fixtures used for broaching are simple in design and inexpensive to make. There are cases, however, when something more elaborate is needed in order to decrease the setting up time or when the work is of such a character that it cannot be supported and clamped properly in a simple type of fixture.

In considering the design of broaching fixtures, the designer must first realize that there are two methods in use. Fig. 186 illustrates diagrammatically both forms of broaching processes. The work shown at *A* is set up on the table of an arbor press at *B*. The

broach *C* is short and is pushed through the work by means of the press spindle. Attention is called to the fact that all push broaches must be short and that the usual method is to push several of them through the work, one after another, each one being so proportioned that it will remove a little more stock than the one which preceded it. The end *D* should be so made that it will act as a pilot when entering the work. The teeth are so proportioned that each tooth is slightly larger than the preceding one. The amount of this variation is dependent upon the material to be cut and the shape and size of the hole.

The piece of work shown at *E* is broached by pulling the tool through the work instead of pushing it as in the first instance. This work is done on a horizontal broaching machine designed strictly for the broaching process. In contrast with the other example shown, the broach *F* is long, usually from 24 to 36 in., depending on the capacity of the machine and also upon the amount of stock to be removed. It will be noted that the pulling action of this broach is resisted by the faceplate *G* on the machine itself. The portion *H* acts as a pilot and centers the broach in the hole, as in the preceding example.

A bushing which acts as a shaft bearing is often provided with an oil groove. When the work is manufactured in small lots a cold chisel of the proper form is frequently used and the operation is done by hand. If the production is large, other methods can be used according to the depth of the groove, the material which is to be cut, and the machines which are available.

Fig. 187 shows a piece of work *A* in which an oil groove is cut at *B*, this groove being shallow as indicated in the illustration. In this case the work rests on a bushing *C* and the machine used can be an arbor press or other similar machine. It might be possible to use a drill-press spindle to apply the pressure if no other machine were available. The cutter or broach bar *D* is a sliding fit in the bushing and an adjustable cutter is provided at *E*. By means of the screw and binding shoe *F* the cutter can be held in any position desired.

The bar itself is located in the bushing by means of the teat screw *G* which enters the slot *H* in the bar. It is evident that the depth of the groove is controlled by the position of the cutter, and there may be cases when two or three cuts are needed in order to produce the desired results. Oil grooves are usually shallow so that a single cut will often be found sufficient. In the event of a deep cut being required, it would be better to run the work through several times, adjusting the cutter a little more for each successive cut, rather than to attempt an adjustment several times on each piece of work. It would be possible, however, to make a bar with rapid adjustment features if this seemed desirable.

A method of this kind may be found useful occasionally for work that is being rushed, or when production is such that the expense of a broach of the regular form is not warranted. This process can also be used for high production if the cut is very shallow, in which case certain refinements may be found advisable. A bar can be made in such a way that the upper end is held in a drill press spindle, and the cutter *L* mounted in an adjustable block *M*, as shown in the sectional illustration at *K*. The block can be held by setscrews as at *O* and *P* in the upper view. After the cutting has been done the drill press spindle is raised. The cutter rubs lightly against the groove during the movement, but does not injure the work.

Certain varieties of work that are to be broached do not require fixtures of any kind, although occasionally bushings may be necessary if the work is small. In Fig. 188 are shown several examples of work which require nothing but a bushing large enough to admit the broach. Example *A* is a cylindrical piece in which the round hole is to be broached after it has been drilled; *B* is a square hole broaching proposition; *C* is a four keyway job; *D* is a collar having a number of inside serrations.

Each one of these pieces can be broached without fixtures by using the method shown in the diagram. The work *E* may be any one of the pieces illustrated above, and it may be seen that the only thing which must be provided except the broach itself, is the bushing *F*. Even this is unnecessary if the work is of sufficient diameter so that it will rest firmly against

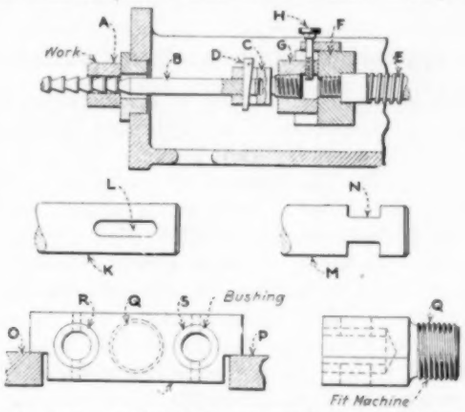


FIG. 190. METHODS OF BROACH PULLING

the faceplate on the machine. The broach is so made that the portion *G* acts as a pilot in the work, thereby centering it so that as soon as the first tooth strikes the work it is drawn back against the faceplate and held there during the cutting action.

A number of matters must be taken into consideration in the designing of broaches for various purposes. Some of these points have been taken up under another heading in the first part of this article. There are others, however, which cannot be properly covered in a general way, therefore these will be mentioned specifically.

A few examples are given in Fig. 189 in order to make some of these points clear to the tool designer. The work *A* has been properly prepared for the broaching process by drilling a hole and facing one side square with the hole. It will be seen that this piece of work is not very thick so that if a broach were to be used such as that shown, only one tooth of the broach would be cutting at a time. In other words, the distance between *B* and *C* is too great so that the work may drop down—off center—and thus either break some of the broach teeth or produce work which is off center or otherwise inaccurate. Two or more teeth of the broach should always be in the hole at the same time, and yet there should not be too many to allow for clearance for chips. As there is no way in which chips can get out from between the teeth until they reach the end of the hole it is evident that an accumulation is likely to clog the broach, causing breakage or rough work.

The example *D* shows a long hole and it can be seen that there are too many teeth engaged in the work at the same time. It is advisable therefore in designing broaches for long holes, to space the broach teeth farther apart than when the work is thin. The example *F* shows a good arrangement in which there are always two and sometimes three teeth in the hole at the same time as indicated at *G*. There is plenty of chip clearance, however, so that the cutting action is good and the work produced will be both accurate and smooth.

It can readily be understood from the foregoing discussion that a broach of the same diameter may not always be suited to two different pieces of work if one happens to be thick and the other thin. This objection can be overcome if the work can be arranged or stacked two or three pieces at a time. If the condition is similar to the one shown at *A*, suitable provision must be made for clamping the various pieces together so that they can not drop down on the broach during the operation.

Spacing of Teeth and Chip Clearance

The diagram of the broach at *L* illustrates the points that are of importance in designing broaches. The *pitch* of the teeth is the distance between them as indicated at *H;* the amount of variation being determined by the material to be cut and the length of the hole. A formula which is often used for determining the correct distance, is here given. Assuming *P* as the pitch and *L* as the length of the hole, then: $P = \sqrt{L} \times 0.35$. This formula can be considered as reliable for average conditions and it will serve as a basis on which the designer can determine the correct pitch for any given condition. As a general thing, very large broaches which will permit a deep space for chips can be designed with a decreased pitch, while those broaches which are to be used for tough or hard materials may require a slightly increased pitch.

The variation in the size of successive teeth is indicated at *K* and *L;* this amount, ranging from 0.001 to 0.003 in. for steel and sometimes double this amount for soft cast iron and brass, is influenced by the length of the hole to be broached so that too great an amount of metal may not be removed by a number of teeth in engagement at the same time. The *land* on the teeth is indicated at *M*, the amount usually being about $\frac{1}{32}$ in. for medium sized broaches. The land on the teeth is sometimes ground straight but ordinarily there is a back taper of from 2 to 3 deg., as indicated at *O*.

N indicates the clearance, which depends largely on the length of the hole to be broached and the amount of metal which each tooth is to remove. It is also affected by the diameter of the hole as previously mentioned. An important point in this connection is the fillet at the root of the tooth. This should be made as large as possible, both for strength and also so that there will be less likelihood of cracks during the hardening process.

Plain Broaches

Plain broaches are usually made with the last few teeth the same size in order to assist in the upkeep of the tool. After grinding a few times the number of teeth of the same size will be gradually reduced until finally there is only one sizing tooth left, after which nothing further can be done and the broach must be discarded or used for a smaller size after re-grinding. Some forms of broaches can be made up in a series of units as indicated at *P*, *Q* and *R*, and mounted on an arbor *S*. It is evident that the units can be provided with a keyway for location and they can be held on the arbor by means of check nuts as shown at *T*. If the size of the broach permits, it is as well to put the nuts on the forward end and provide a shoulder at the rear for the various cutters to be drawn against. The size and method of coupling used have an effect on this part of the design.

Broaching Round Holes

When round holes are to be broached, a good finish can be given to the work by burnishing it or swaging it as shown at *U*. In this case a burnishing broach *W* of rounded form is drawn up against the shouldered portion *V* by means of the nut at *X*. After the cutting has been done the rounded portion is pulled through, thus producing a very fine finish and also compressing the metal so that a hard wearing surface is obtained.

Broaches having considerable area often can be made to cut more freely by nicking the teeth as shown in the diagram at *Y*. The nicks must be so arranged that they overlap each other as at *Z*. An arrangement of this kind breaks up the chips and assists in cases where hard metal is encountered or on broad surfaces.

Broach Couplings

The method of connecting the broach to the pulling member of the broaching machine permits the operation of coupling and uncoupling the broach to be done rapidly. Provision of some sort must also be made so that either the work may be adjusted vertically in relation to the broach, or that the broach itself can be adjusted in relation to the work. Sometimes the faceplate is adjustable up and down and in other cases the broach coupling is provided with adjustment.

In Fig. 190 is shown a piece of work *A* and a broach *B*, the latter being connected to the pulling member of the broaching machine by means of the taper pin *D*.

The coupling slide *F* is mounted on the ways of the machine and suitably fastened to the screw *E*. The holder *C* screws into slide *G*, which can be adjusted by means of screw *H*, so as to bring the broach into the correct position with relation to the work.

Methods for Slotting the Ends of the Broach

The detail at *K* shows a common method of slotting the end of the broach when a pin coupling is used like that shown above. Another method is indicated at *M*, this arrangement consisting of a milled slot on each side of the bar. There are occasional instances when it is desirable to pull more than one broach at a time in a horizontal plane and when this becomes necessary it is obvious that some other form of coupling must be used. A case in point is shown at the lower left-hand corner of the illustration, the coupling member *X* being mounted on the ways of the machine at *O* and *P*. The screw portion *Q* fits the pulling member of the machine, while the broaches are held in the usual manner at *R* and *S*. In such a case care must be taken by the designer to see that the pulling action is distributed equally on both broaches so that there will be no chance of cramping during the operation.

(Continued in next week's issue.)

Hydraulic Press with "Oilgear" Control

Control Adapted to Both Linear and Rotary Drives—Flexibility and Accuracy of Control Render it a Valuable Adjunct to Many Types of Machines

SPECIAL CORRESPONDENCE

ANOTHER use for the variable delivery pump (illustrated with the "Oilgear" transmission in a previous issue) is in connection with an hydraulic press as shown in Fig. 1. The press is

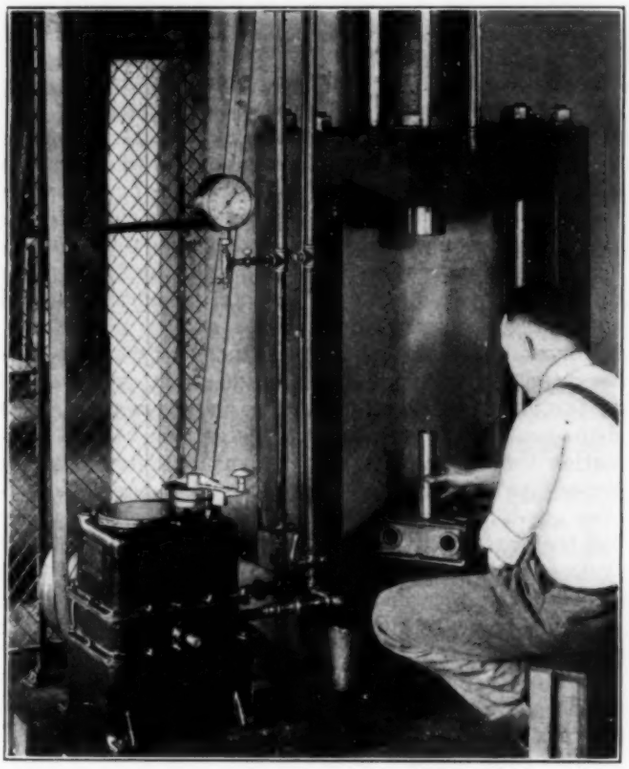


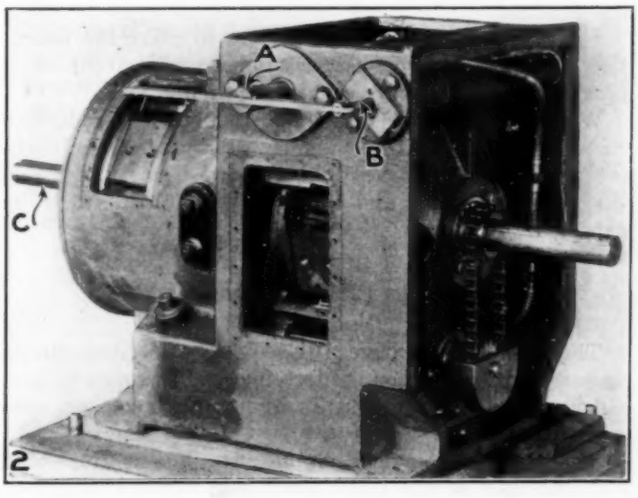
FIG. 1. OILGEAR CONTROL ON PRESS

driven by the standard Oilgear feed controller, requiring only a belt drive from the lineshaft. It has a rapid traverse of the ram of from 3 to 4 ft. per minute up or down, with pressing speed of about 6 in. per minute at 20 tons per square inch. Larger pumps would give more rapid ram traverse for production work.

The Oilgear Company, Milwaukee, Wis., has also built and tested a small lot of a larger type of machine designed to drive the spindles of machine tools at any desired speed, either from lineshaft, constant-speed electric motor, or gasoline engine. A general view of one of these units of about 10-hp. capacity, designed for driving a large lathe is shown in Fig. 2. Through the hand holes, which are shown with the covers removed, any or all of the plungers may be removed and replaced in a few minutes should inspection of them be required. The open end of the casing shows the swinging cradle by which the pump stroke is changed, the hydraulic operating gear being shown at *A*. The rod connecting an overload control cylinder to the operating lever is indicated at *B*. This rod remains stationary and acts as a fulcrum for the control lever so long as the predetermined safe pressures are not exceeded. When the pressures become excessive from any cause whatever, the automatic overloaded gear takes control and shifts the pump stroke until the excessive pressure is relieved. For instance, when driving a machine tool, the hydraulic drive will begin to reduce the speed if the cut becomes excessive, even to the point of stopping the machine entirely until the operator either withdraws the tool from the cut or reduces the feed or depth of cut. On the other hand, if the overload is only temporary, the hydraulic transmission will automatically start the machine again as soon as the load is reduced. The driving shaft of the variable speed motor is shown at *C* extending from the end of the casing at the left.

Fig. 3 shows the pump end of casing with the swinging pump unit removed.

The manufacturer states that long-continued runs of the hydraulic transmission mechanism under heavy continuous loads, prove that very little wear occurs as all revolving and sliding fits work on oil films without metallic contact. It will be noted that all of the plunger thrusts are taken on roller bearings, and that there are no connecting rods or wristpins.



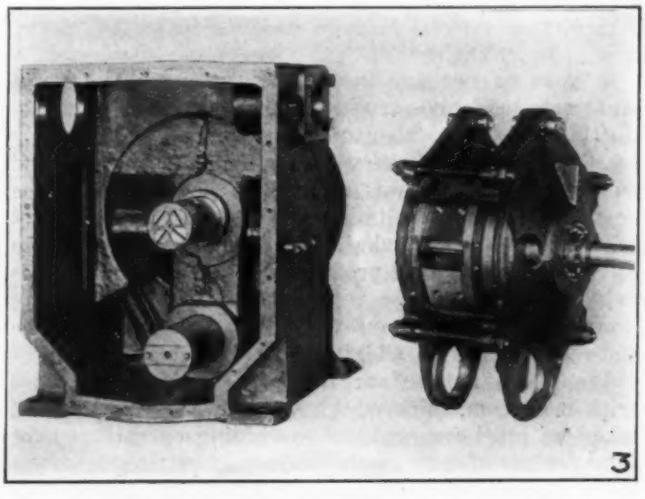


FIG. 2. A 10-HP. CONTROL. FIG. 3. SWINGING PUMP REMOVED

Non-Productive Costs

A Recent Editorial in the "American Machinist" and the Comments of Several Machine Tool Builders

MACHINE-TOOL builders, shop managers and production men are all keenly interested in reducing the cost of production, and rightly so, for much remains to be done in that direction. But the problem of getting business on a normal basis includes much more than shop costs which are often relatively small.

Take, for example, the case of a well known automobile where the production cost is but 10 per cent of the selling price. The car sells for approximately $3,000. The shop builds the motor, transmission, front and rear anxles, and many other parts—more in fact than with most cars of similar grade. Yet the actual production cost is less than $300.

Nor does this necessarily mean that an exorbitant profit is being made. The great discrepancy is due to non-productive costs, between the shop and the consumer. These costs may include shop overhead, elaborate cost systems, too much office expense, high selling costs and various other expenses. But as long as these costs exist the shop man can hardly be expected to worry much about reducing shop costs. It also shows the futility of ascribing all our troubles to high wages in the shop. If these men worked for nothing it could not make more than $300 difference in the cost of the car to the consumer.

One has only to recall the days when bicycles were distributed from expensive showrooms and to remember that we paid $150 each for them. Today we buy a better wheel for $40 or less—and the manufacturers, we trust, make a good profit at that. But they have eliminated much of the non-productive costs which formerly existed.

Just how far this condition is true of other lines is known only to those in the various industries. But whether large or small, non-productive costs must receive at least as careful attention as shop costs. They form one of the glaring economic wastes to which Mr. Hoover is so well devoting so much of his attention.—From the *American Machinist*, June 9, 1921.

BY RALPH E. FLANDERS
Manager, Jones & Lamson Machine Co.

A year or two ago in going over our cost reports we were suddenly struck by the fact that our productive or direct labor expense was a comparatively small percentage of the whole cost of manufacture and selling. In fact it was so small a percentage of the cost that if we had eliminated it entirely it would not have enabled us to make a big enough profit extra, to put us in the class of profiteers. It, therefore, became evident to us that the real place to work for cutting down costs was not on the direct labor but on the indirect charges of all kinds.

We would not be surprised if this were the case with most companies who have, as we have ourselves, made an intensive study of machining operations over long periods of time, with the idea of cutting down the direct labor cost to the smallest possible amount consistent with good wages and good workmanship. We will, therefore, follow with interest your campaign on this subject, which we believe to be badly needed.

BY AUGUST MARX
Vice-President, G. A. Gray Co.

We were very much interested in your recent editorial on "Non-Productive Costs." We agree absolutely that present conditions demand a rigorous scrutiny of each expense item, whether it be part of the so-called "non-productive cost" or the direct labor and material cost.

We feel, however, that the machine-tool industry as a whole cannot be charged with wastefully elaborate cost and production systems, excessive or overpaid engineering and office personnel or extravagant advertising and selling practices. To our minds the faults along this line lie not so much in the total amounts expended but in the results obtained.

For example, we feel that the industry would not be benefitted by reducing the amount spent on cost and production systems but that the management of each shop should make certain that it is getting useful information for the salaries paid and not merely compiling impressive but valueless statistics. Too many cost figures are like post mortems. They may help posterity but they are of little good to the patient. A real cost system is not a luxury to be cast aside as soon as hard times come but a warning beacon that should be of quite as much value in times of industrial storm as under normal conditions.

Again, instead of disrupting a carefully built up engineering force, might it not pay to set your force to work on a constructive criticism of the present design of your product, with the following aims in view:

(1) To determine whether any particular device is really worth while from the user's standpoint, i.e., whether it is a commercial feature or a mere talking point.

(2) To cheapen the production cost by more careful investigation of the design than was practical during the rush years.

(3) To insure dependability and low upkeep cost of the product.

(4) And perhaps most important, to make the operation of the various devices as simple and convenient as possible so as to secure maximum production.

While such a plan would not reduce non-productive costs it would give the customer machines of the highest productive efficiency at the lowest cost at which they could be built and that is all that can fairly be expected.

BY E. F. DUBRUL
General Manager, National Machine Tool Builders' Association

The editorial on page 1011, Vol. 54, strikes me as presenting a very good subject for business men to consider; that is, reduction in their overhead, or non-productive costs.

The three theological virtues are Faith, Hope and Charity, and as the Good Book says, "the greatest of these is Charity." So with costs, the three main ele-

ments are Labor, Material, and Overhead, and during the last few years in a great many cases "the greatest of these was Overhead."

Perhaps not many businesses would show such a large percentage of overhead as on the automobile mentioned in the editorial, where the direct production costs were less than $300 on a car retailing for approximately $3,000. The spread of $2,700 is certainly ample to take care of very large expenditures for the most efficient overhead possible and leave a very handsome profit besides. If there are very many cases of this sort, competition in a buyers' market can well be trusted to whittle down the price. The wise manager who has an excessive overhead will begin to turn off the excess in that overhead with a very drastic knife, before his competitors force him to do it.

The world today is so short of capital, due to the destruction of war, that wastefulness in overhead cannot be tolerated, and the sooner this condition is recognized the quicker will overhead costs be gone after. It is in overhead and in elimination of unnecessary idleness that manufacturers must look today for big savings, perhaps larger than they can find in their production. Of course production savings should not be neglected. If the Committee on Waste is right in its preliminary surveys, there is a fruitful field in the study of waste. Stopping a loss is just as good as making a profit when it comes to the balance sheet figures at the end of the year.

The aftermath of the war, coupled with the shortage of capital means a strongly competitive era just ahead. The man who cuts out his losses will be better able to make a profit than the one who lets his losses ride. Many a loss has existed in overhead that could well be eliminated. Such losses were easily imposed on business during the war period. But now it is time to mercilessly reduce them.

By H. Ezra Eberhardt
Secretary, Gould & Eberhardt

Non-productive costs, especially in such a depressing period as the present, seriously affect every manufacturer, and since they represent and constitute such a large part in the element of costs, it is necessary to control and reduce and keep this portion of expense to a minimum at all times.

A general interchange of ideas in the methods of administering, applying and regulating non-productive costs would form very interesting as well as constructive reading matter, and would no doubt aid many manufacturers in the operation of their plants, not only during the present readjustment period, but in prosperous times as well.

As for ourselves we find that there are a number of fundamental departments in our organization that must be carried on if we would hold our shop together. For instance, the following departments must not be dropped even though only a few repair orders come in, and these departments constitute the making up of an overhead account: (1) Managing; (2) opening of mail; (3) answering correspondence; (4) entering orders; (5) shop production, which includes supervision, designing, routing of work and inspection, timekeeping, repairs, power, and stockroom; (6) shipping, boxing, painting; (7) paymaster; (8) cost department; (9) general expenses, which include taxes (city and government), water, light, interest on investment, insurance, sales promotion literature, service men on road, engineering service, advertising.

Of course all of the expenses enumerated vary according to the amount of business done and the amount of production carried on in the factory, but each item is an essential part of a well organized business if it would "carry on," even in the dullest times.

The important question at present is to see how to continue these functions with the least amount of help. In many cases one man can "overlap" or do the necessary work to keep two or three or more of these departments going, whereas formerly it might have taken two, three or more men to keep the one department going. This, then, is the important point to consider now, that is, how much can one man do or, how many men does it take to keep all of the fundamental departments going. We are endeavoring to accomplish the work by having each man work 100 per cent efficient, both as to his methods of work and physical application, instead of 50 per cent as was the common practice of us all, over the entire country during the rush boom.

By C. R. Snoke
Comptroller, the Bullard Machine Tool Co.

The problem of keeping items of non-productive cost down to a minimum is one that requires careful attention and eternal vigilance. Careful analysis of any classification of non-productive costs will almost invariably reveal the fact that many wastes and extravagances are present.

One of the best known means for its control is the establishment of an expense budget, sub-divided into departments or other suitable divisions. The actual expenses of each department or other division may then be arranged in columns and compared with the estimated budget. In this manner unnecessary expenses may be discovered and a remedy applied.

Successful manufacturers of today make no attempt to route work through their factory without careful planning. There is no good reason why non-productive work should not be planned with the same degree of care. If this planning is not done, there is a tendency for the superintendent or foreman to find something for the men to do solely for the purpose of keeping them busy. The losses from this source will probably be amazing to anyone who has never before attempted the planning of non-productive labor.

Non-productive material in the nature of supplies, repair parts, etc., should be placed under control of the storeskeeper and issued only on properly signed requisitions. This will permit purchasing in larger quantities, taking advantage of quantity prices and the cutting down of the amount carried on hand throughout the plant. It will also be found possible to standardize the various kinds of supplies and parts.

Nearly every manufacturer, particularly in the metal goods line, was concerned with the making of war materials of some kind, and in a great many instances purchased extra or special equipment for this work. In cases where this equipment is not required, or is not suitable for use in connection with the turning out of the regular product, it is unfair to charge the cost of carrying this equipment, depreciation on the same and other expenses in connection therewith, to the cost of the present output. Equipment of this kind should be disposed of to the best advantage possible so as to make the space available for profitable use.

It is quite as important to plan and route the office work as that of the factory. Better results will be obtained with a smaller clerical force and duplication of records avoided, as well as the apparent necessity for obtaining additional office space and equipment.

In making additions to the office personnel, it has been found economical to have new employees, after getting an idea of the work they are to do, spend some time in departments other than those in which they eventually are to work. In this way they acquire an understanding of the correlation of their work with that of other parts of the office, and details which may seem monotonous and unimportant are given better attention when employees have a knowledge of the use made of their contribution of effort in connection with the work of the office as a whole.

It is a well known fact that if particular attention is paid to the little things, the big ones will take care of themselves. With this in mind the following notice was handed to all employees in the office, and within a very few days it was talked of as the "Think" memorandum:

To: Office Employees.
From: Comptroller's Office.
Subject: *LITTLE THINGS*

"Many littles make a much."

This applies to items of expense, the same as to anything else.

Let us watch the little items.

THINK

before incurring expenses for, or using extravagantly—

Telephone toll calls
Telegrams
Office Supplies
Service Car
Messenger Service
Paper Towels
Electric Light
Power. (Do not permit motors on office appliances to run idle.)

Last, but not least, do not waste Time—yours or others.

"The hour you lose has the same money value as the one you use."

If another part of the office has information you require, ask for it—by telephone, don't walk—and do not spend time getting the same facts together again. But—THINK—before asking someone to take time from his work to do something for you.

No one has a moral right to waste anything—his own property or that of others.

THINK

Torsional Strength of Multiple-Splined Shafts*

By C. W. SPICER

Vice-president and chief engineer, Spicer Manufacturing Corporation, South Plainfield, N. J.

There has been some discussion at various times regarding the torsional strength of splined shafts. So far as I am aware this discussion has led to very little available published data on the subject. The results of some recently completed tests will, therefore, be of interest. In presenting this brief paper it is intended to describe only the actual tests, the conditions under which they were carried out and the results obtained. No attempt will be made to develop the theory involved.

The discussions referred to have, so far as I know, been principally along the line of personal opinions; some believing that the torsional strength of a multiple-splined shaft is little if any greater than a full round shaft of a diameter equal to the small diameter of the splined shaft. Superficially, it would seem obvious that the torsional strength of a multiple-splined shaft is greater than that of the full round shaft just referred to. Whether this is so will be evident shortly from an experimental point of view.

A series of tests was run on 15 carefully machined shafts, as indicated in Fig. 1. The dimensions shown are the actual ones of the test-pieces, there being not more than 0.0005-in. variation in any shaft from the diameters shown. Heat-treating was very carefully carried out, and each specimen checked by Brinell instrument on the ends and by sclerescope throughout the length, the Brinell numbers lying between 220 and 235, and the extremes of scleroscope hardness being 38 and 43. It was at first intended that the small diameter of shafts Nos. 1 to 5 should agree exactly with the small diameter of shafts Nos. 6 to 10. It was decided after the heat-treating had been done to avoid any straightening operations and, therefore, the small diameter of shafts Nos. 1 to 5 was reduced to a size that would clean up the most badly warped shaft by grinding. This also accounts for the large diameter of shafts Nos. 6 to 10 being below the 1⅝-in. nominal diameter. However, none of these details materially affected the results, as will be seen later.

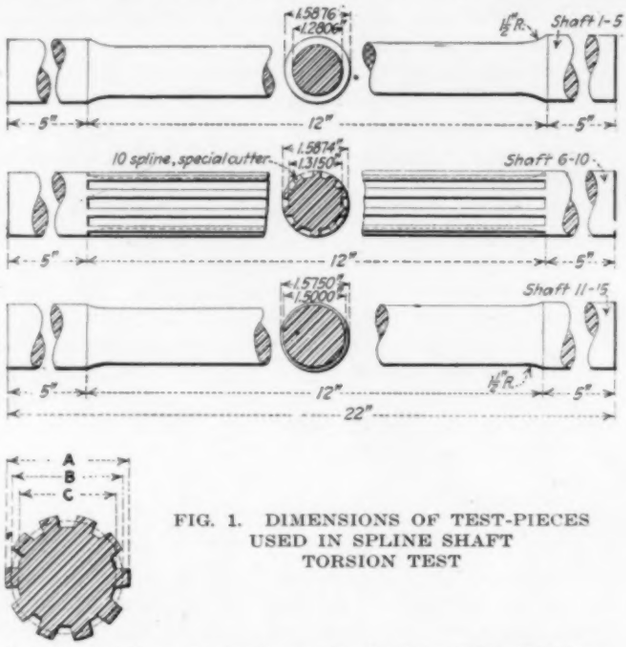


FIG. 1. DIMENSIONS OF TEST-PIECES USED IN SPLINE SHAFT TORSION TEST

It will be noticed that the small diameter of shafts Nos. 11 to 15 lies between the large and the small diameters of shafts Nos. 6 to 10 in approximately the relation shown in the lower left corner of Fig. 1. This diameter represents a shaft which, according to one authority, is hypothetically equivalent to the splined shaft in torsional strength. That it is far from equivalent will be seen later.

All readings from which the curves shown in Fig.

*Presented at the Annual Meeting, Jan. 12 and 13, 1921, of the Society of Automotive Engineers.

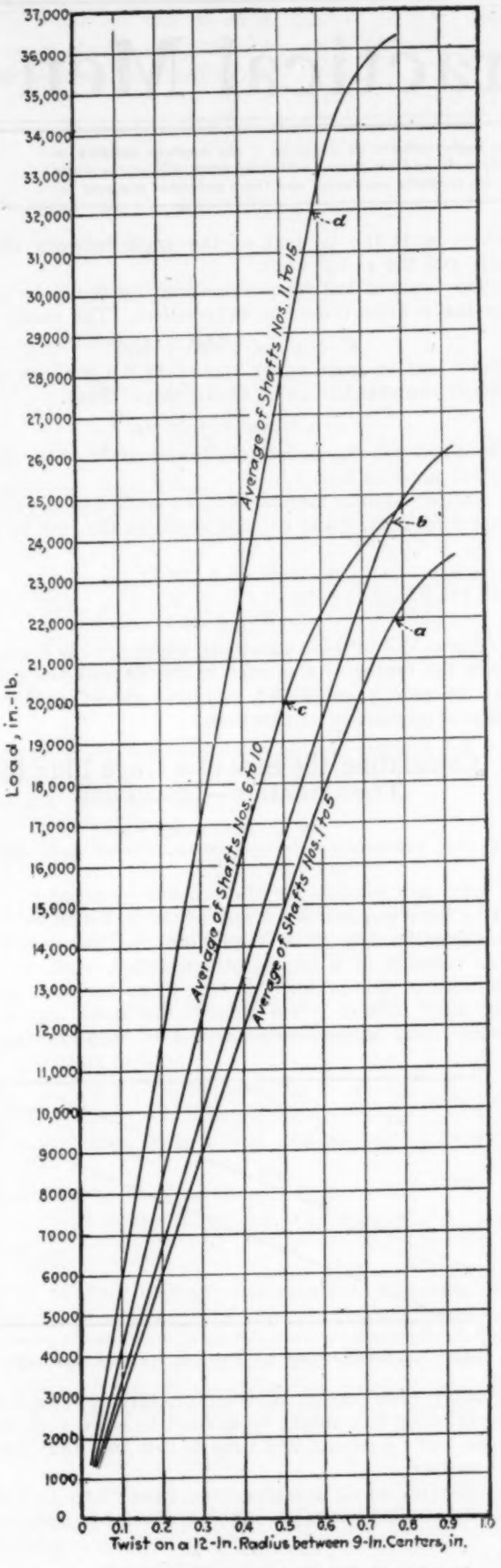

Load, in.-lb.
Twist on a 12-In. Radius between 9-In. Centers, in.
Average of Shafts Nos. 11 to 15
Average of Shafts Nos. 6 to 10
Average of Shafts Nos. 1 to 5
a
b
c
d

FIG. 2. COMPOSITE CURVE OF TEST RESULTS

2 were prepared were taken by the Olsen troptometer attachment.

The results of the individual tests of the five specimens of each group were very uniform and it therefore does not seem necessary to give the detail curves of each specimen. The curves shown in Fig. 2 represent the average of the five shafts in each group, and are self-explanatory. Curve *a* is the plotted average of shafts Nos. 1 to 5. Curve *b* is curve *a* corrected for a diameter equal to the small diameter of shafts Nos. 6 to 10. Curve *c* is the average of shafts Nos. 6 to 10; and curve *d* is the average of shafts Nos. 11 to 15.

The positions of the letters *a*, *c* and *d* also indicate the location of the so-called Johnson elastic limit; that is, the point at which the unit increment of deflection per unit of load increase is 50 per cent greater than at the beginning.

Comparing curves *b* and *c* it will be readily seen that a splined shaft of the dimensions given has a torsional elastic limit of approximately 18 per cent less than a full round shaft of a diameter equal to the small diameter of the splined shaft. The elastic limit of the hypothetically equivalent shaft is very much higher.

A Mechanical Encyclopedia

BY ALBERT F. GUYLES
Beeston, England

On pages 385 and 942, Vol. 54, of the *American Machinist*, C. V. Lovell and P. A. Fredericks describe and comment on a "Loose-Leaf Mechanical Encyclopedia," formed from pages cut from mechanical journals. I tried that method of preserving information a number of years ago and have often regretted it. I still have the folders but for the most part the information I desire is in the other half of the article on the back of the sheets which I have retained.

The trouble arises from the fact that the information which we consider of the most interest to us today is not necessarily that which will be of the most use to us in the future. We may read an article with interest this week on an object or operation which will not be of the slightest use in the line in which we are engaged; men do not often change their occupations suddenly, but men and firms change the articles they manufacture gradually, and in a few years we recollect having read of a tool or operation which would help with our new class of goods. We remember the general idea but the detail can only be obtained by re-reading the article. Of course that is one of the things we did not save. Who would have thought that we would now be making typewriters, when twelve years ago or less our line was steam-engines?

Some years ago I commenced to save the whole of the issues and have them bound up with the publishers' index and I often look at those old folders and wish that they were in the same condition as the later copies.

Of course eighteen volumes of the *American Machinist* take up a little room, and articles on the same subject do not come together, but for reference I find them more convenient than the folders; and they will stand on a bookshelf, while there is not the tendency to shove them "anywhere out of sight" which one has with folders.

Even with the volumes, a subject index is useful; my own being a thumb-indexed notebook. The subject being at the top of the page it is only necessary to note the initials of the journal, volume and page. A quickly made, easily found and not bulky reference.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Cutting Odd Shapes on a Milling Machine

By Lawrence H. Bailey

In the manufacture of odd-shaped punches on a milling machine it has been found a great time-saver to lay out the shapes on a large scale and then draw in radial lines, corresponding to the divisions of some index

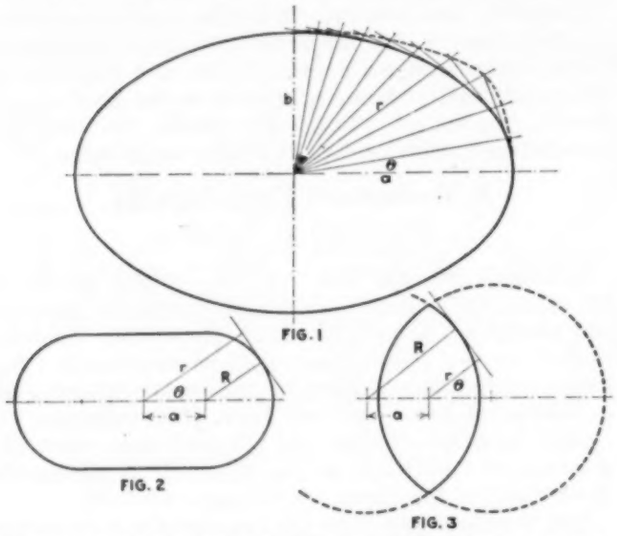


FIG. 1. LAYOUT FOR ELLIPTIC PUNCH. FIGS. 2 and 3. METHODS OF LAYING OUT IN POLAR CO-ORDINATES

circle on the milling machine head. Tangents to the odd-shaped curve made perpendicular to the radial lines, cut the radial lines at distances from the center of the figure which correspond to the distances from the center of the work to the face of the cutter.

This procedure saves all cut and try methods, and the use of templates. The milled punch is smoothed up with a file to remove the slight ridges left between the successive cuts.

This method as applied to an ellipse is shown in Fig. 1. A still more accurate and rapid method can be used in the case of regular figures for which a mathematical expression is known. From the equation of the curve, it is a simple matter to derive the equation of the locus of the intersection of the radial lines with the perpendicular tangents. By substituting the various angles in this expression, the perpendicular distances corresponding to each angle can be accurately figured.

For an ellipse, the semi-diameters of which are a and b, the mathematical expression is

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$$

The radial line may be expressed thus:

$$y = mx.$$

The tangent line to the ellipse at right-angles to this is

$$y = \frac{-x}{m} + \sqrt{\frac{a^2}{m^2} + b^2},$$

where m is the tangent of the angle between the x-axis and the radial lines.

The locus of the intersection may be found by eliminating m from these two expressions. The result is

$$x^2 + y^2 = \sqrt{a^2x^2 + b^2y^2},$$

which may be more easily applied to the work in question if expressed in polar co-ordinates, thus:

$$r = \sqrt{a^2 \cos^2 \theta + b^2 \sin^2 \theta}$$

These last two expressions are the equation of the heavy dotted curve in Fig. 1.

Entirely similar methods may be applied to the shapes shown by Figs. 2 and 3. The result in the case of Fig. 2 is

$$r = R + a \cos \theta;$$

and for Fig. 3,

$$r = R + a \cos \theta;$$

Values of r in these equations, which are the distances from the center of the work to the face of the cutter, can be readily calculated with the aid of a table of natural trigonometric functions.

Calculating the Size of a Gage Plug by Triangulation—Discussion

By C. E. Pearce
Associate Professor of Machine Design, Kansas State Agricultural College

Here is a solution for the problem proposed on page 31 of the *American Machinist* by A. D. Hallet on "Calculating the Size of a Gage Plug by Triangulation." The solution of a biquadratic equation, such as that obtained in this problem, is easy in an algebraic sense, but very difficult when figures are used instead of letters. An approximate method of solution that is

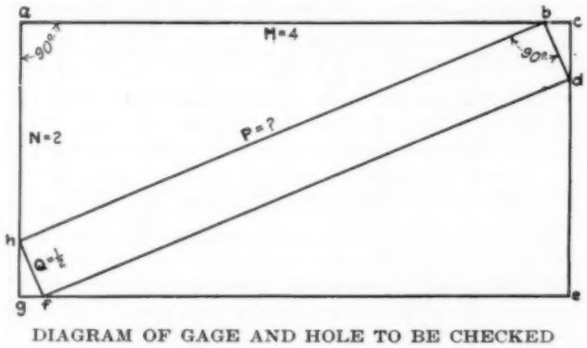


DIAGRAM OF GAGE AND HOLE TO BE CHECKED

probably close enough is, therefore, given. I believe a special slide rule might be devised to solve such equations, but I have not had time to look into that side of the matter.

Referring to the accompanying figure, here is a solution by similar triangles. Δabh is similar to Δghf,

Then $$\frac{ab}{hg} = \frac{ah}{gf} = \frac{bh}{hf}. \quad (1)$$

Also $$bh^2 = ab^2 + ah^2; \quad (2)$$

And $$ac = ab + gf, \quad (3)$$

$$ag = ah + hg. \quad (4)$$

Let, $ac = M$; $ag = N$; $bh = P$; and $hf = Q$.

From equations (1) and (3),

$$ac = ab + ah.\frac{hf}{bh}$$

$$\therefore M = ab + ah.\frac{Q}{P} \quad (5)$$

From equations (1) and (4),

$$ag = ah + ab.\frac{hf}{bh}$$

$$\therefore N = ah + ab.\frac{Q}{P} \quad (6)$$

Taking (5) and (6) together,

$$ab = \frac{P}{Q}\left[N - P\left(\frac{MQ - PN}{Q^2 - P^2}\right)\right] \quad (7)$$

$$ah = P\left(\frac{MQ - PN}{Q^2 - P^2}\right) \quad (8)$$

Substituting these values in equation (2),

$$P^2 = \frac{P^2}{Q^2}\left[N - P\left(\frac{MQ - PN}{Q^2 - P^2}\right)\right]^2 + P^2\left[\frac{MQ - PN}{Q^2 - P^2}\right]^2 \quad (9)$$

$$o = \left(\frac{MQ - PN}{Q^2 - P^2}\right)^2 (Q^2 + P^2) - 2NP\left(\frac{MQ - PN}{Q^2 - P^2}\right) + (N^2 - Q^2) \quad (10)$$

And this simplifies to,

$$P^4 - P^2(M^2 + N^2 + 2Q^2) + 4PMNQ - (M^2 + N^2 - Q^2)\,Q^2 = 0 \quad (11)$$

There does not seem to be any general solution for this equation that can be used conveniently.

In the problem proposed for solution, $M = 4$ in.; $N = 2$ in.; and $Q = \frac{1}{2}$ in.

Equation (11) then becomes,

$$P^4 - 20\tfrac{1}{2}P^2 + 16P - 4\tfrac{15}{16} = 0 \quad (12)$$

The following approximate method of solution for (12) will probably be satisfactory:

If, $P = 4$, the equation $= -12\frac{15}{16}$;

$P = 5$, the equation $= +187\frac{5}{16}$.

Thus the answer is known to be between 4 and 5, and probably close to 4.

If, $P = 4.1$, the equation $= -1.367$;

$P = 4.2$, the equation $= +11.81$.

It is, therefore, known that the answer is between 4.1 and 4.2.

The differential of equation (11) is:

$$4P^3 - 2P(M^2 + N^2 + 2Q^2) + 4MNQ = 0 \quad (13)$$

Or, $$4P^2 - 41P + 16 = 0 \quad (14)$$

If (F) be used to represent equation (12) and (F') to represent equation (14), then Newton's method of approximate solution is as follows: Since we know that $4.1 < P < 4.2$, let us assume a first approximation as $P = 4.15$. Then, substituting this value in (F) and (F'), that is, in equations (12) and (14), we get,

$$\left(\frac{F}{F'}\right) = \frac{+5.02}{+131.75} = +0.0381 \quad (15)$$

With a positive value for (F), it is known that the answer must be less than $P = 4.15$. So let us correct this value by that of equation (15), or

$$P = 4.15 - 0.0381 = 4.1119.$$

Substitute this value in (F) and (F'), as before. Then

$$\left(\frac{F}{F'}\right) = \frac{+0.12}{+125.50} = +0.00096 \quad (16)$$

The approximate answer to equation (12) is, therefore.

$$P = 4.1109$$

If this answer is not close enough, the method outlined may be continued; but a logarithmic table of more than five places will be needed to get (F) and (F') to the same accuracy as that required by the answer.

Machining and Hardening Punches

By C. F. Dorr

In all machine accounting based on the Babbage system, small holes are punched in cards, the cards being afterwards sorted and tabulated by machine. The punches used are less than one inch in overall length, being turned and centered on one end to $\frac{3}{32}$ in. diameter up to within $\frac{1}{4}$ in. of the end in an automatic screw machine from stock $\frac{1}{4}$-in. square.

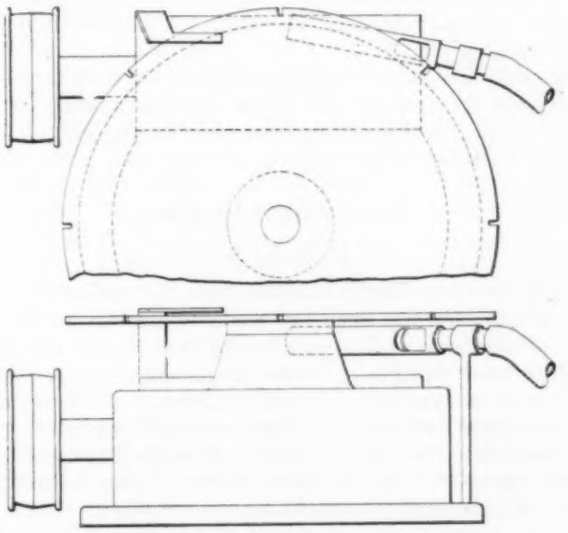
The hardening of these punches has always presented difficulties, as when case or pack hardened in even small quantities they would come distorted, some being too hard and others too soft.

To overcome these troubles, it was suggested that the punches be hardened individually by passing them through a torch flame until heated to the proper degree and then dropping them into a quenching tank.

This proved to be quite a simple and successful method, so a small circular table was made, slots cut in the periphery at equal distances to hang the punches in, and the table mounted on the wormwheel shaft of a rejected drive so that when in operation the table would rotate in a horizontal plane.

As both gas and compressed air were used in the shop, lines were run to where the table was mounted, and a torch placed in position so that the punches would pass through the flame. The sketch shows the general arrangement, the operator placing the punch in the slots by hand as the table revolves. The punches pass through the flame and continue on, until pushed out of the slots by the kickoff bar when they drop into a quenching tank below.

Placed conveniently for the operator are valves for both air and gas regulation. Even at the slow speed



DEVICE FOR HARDENING THE PUNCHES

of table travel it is possible to harden the punches at the rate of 15 per minute.

After hardening, the punches are ground and lapped. The requirements for size are quite severe, not more than 0.0005 in. either out of round or in diameter being permissible.

The punches when ground ran as much as 0.001 in. out of round and the wheel marks showed plainly on the surface. An investigation showed that when the grinding machine was installed, the proper pulley to drive the machine was not available. So a smaller diameter pulley was used until the proper pulley could be ordered—and then the matter was promptly forgotten.

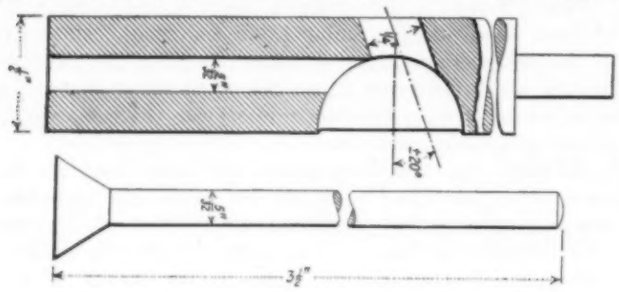
When this was corrected and the grinding machine was run at the proper speed, the punches, when ground, had a mirror finish and could be held within the limits.

Drawing Gear Teeth Rapidly

BY HOMER S. TRECARTIN

The work of laying out gear teeth should not be shirked on a finished assembly view, as it adds greatly to the good appearance and clearness of a drawing to have the gear teeth detailed. I applied a little time-saving idea to this work, which proved better than anything I know of for rapid detailing.

I laid out one gear tooth accurately on a piece of stiff paper. Then I carefully cut this out for a template, including in the piece the center point of the gear circle.



USING TEMPLATE IN DETAILING GEARS

I drew in pencil on the drawing, the circles for the outside diameters of the gears, and spaced them off for the proper number of teeth. On the center line of my template I pricked a small hole at the proper radius from the original line and fastened it over the gear center with a thumbtack, as shown by the accompanying illustration.

It was easy to locate this template for each tooth, by indexing its center line to the spacing marks on the circle. The outline of the gear was thus quickly drawn, either with a pencil or with a drawing pen.

Mechanical Illusion

BY H. S. NITRACENT

Almost every one is familiar with the optical illusions by which straight lines are made to appear curved and by which figures all of one height seem to the eye to be of varying heights. There are illusions of this sort common to everyday life and held by most of us. Illusions about mechanical things are indulged in by many whose work consists of dealing with mechanical things, who apparently should know better. Some instances of this were recently brought to my attention.

The frame of a foot power punching machine which we manufactured had been breaking in use. A recommendation came to me, as consulting engineer, that the frame be strengthened by filling in the holes in the back rib of the frame. This suggestion was made by one of the branch managers, and the idea was highly approved by the official who conveyed the recommendation to me. To the untrained man it might seem quite natural to try to strengthen this frame by filling in the

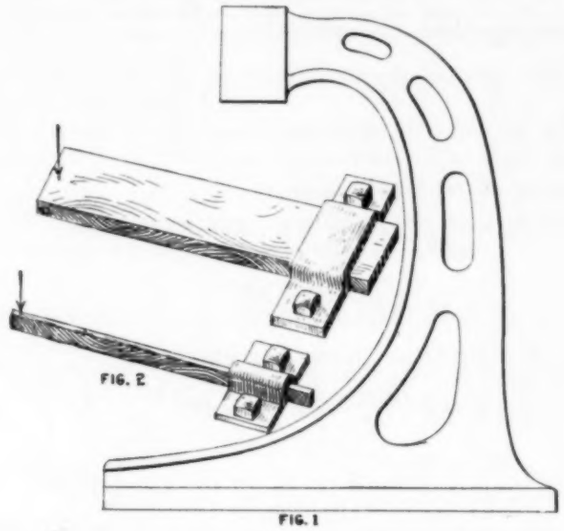


FIG. 1. PRESS FRAME TO BE STRENGTHENED. FIG. 2. A DIVING BOARD, AND A STRIP CUT FROM THE EDGE TO ILLUSTRATE THE SPRING

holes. But calculations showed that only about 1 per cent strength would be added to the frame by applying the metal that way. I recommended that the frame be strengthened by adding an inch to the back of the rib, which added 40 per cent to the strength with no greater addition to the weight than filling the holes would have involved.

On another occasion there was under discussion a spring which had been breaking. It was shaped as shown in the sketch and measured about ⅛ in. thick by ¼ in. deep. The superintendent of the steel department was called in for advice about the spring and he became obsessed with the idea that the spring broke because it was bending "the wrong way." He was used to seeing flat springs which bent the thin way of the metal. It was impossible to convince him that it made no difference how wide the spring was, as it would be bent through the same distance, and the fiber stress would be the same.

It is often helpful in explaining such things to refer to familiar examples which will illustrate the principle, especially where the scientific theory cannot be comprehended. So I drew the diagram of a plank, supported at one end, like a diving spring-board. This was the superintendent's conception of a proper flat spring, and he understood how that could bend without breaking. But when I asked him to visualize a strip an eighth of an inch wide cut off the edge of the board, he could only conceive of it as springing the thin way. Some people are slow to grasp an idea, but I believe that after this man had turned the problem over in his mind a few days, the idea probably came to him suddenly,—that it does not make any difference in the fiber stress of a flat spring, how wide it is, if it is positively bent to a predetermined degree.

Another popular misconception is held regarding the strength of parts. A great many people, including shop

men and mechanics, would believe that doubling the depth of the flat spring referred to above would double its strength or load capacity. Surprisingly few would know that its strength would increase as the square of its depth; or that doubling its depth would increase its strength four times, and that making it three times as deep would make it nine times as strong.

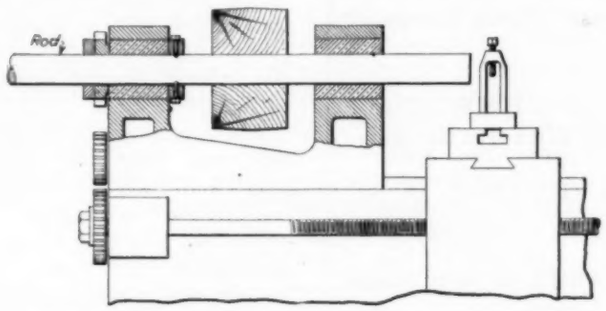
Even in such simple problems training in mechanics demonstrates their practical value. The trained man finds it advisable, occasionally, to apply his scientific reasoning to convince himself of the correctness or error of some of his assumptions in similarly simple analysis. Often what seems to the senses to be a readily apparent fact, proves to be an illusion when checked by scientific theory. So let the worker beware of trusting too greatly the evidence of his senses, which he may think are infallible.

Threading the Ends of Long Rods

BY C. F. DORR

In cutting the threads on rods running from 20 to 40 ft. in length, a repair shop doing mostly hydraulic elevator work, solved the problem as follows: As the bore of the lathe spindle was too small to admit the rods, two cast-iron bushings were first turned up, the bores being the same diameter as the rod, while the outside diameter was the same as the outside diameter of the spindle bearings.

One of the change gears needed to cut the required pitch was then backed up with a heavy cast-iron disk



HOW THE ROD WAS MOUNTED IN THE HEADSTOCK

screwed and pinned to the gear, and both were bored the rod diameter. The spindles and bearings were then removed from the lathe; the gear, jury bearings and collar were placed on one of the rods and the rod placed in the headstock.

A wood split pulley was then clamped down on the rod, belted to the countershaft and the thread cut, using the rod itself as a spindle. As these rods were used as piston rods on hydraulic elevators of the cylinder type, it was necessary to thread both ends, one end passing through the piston and the other through the sheave guide, so any score or spot mark made on the rod while revolving did not materially affect it, as the maximum piston stroke would not push or draw the rod past the score and cause leakage or score the stuffing box.

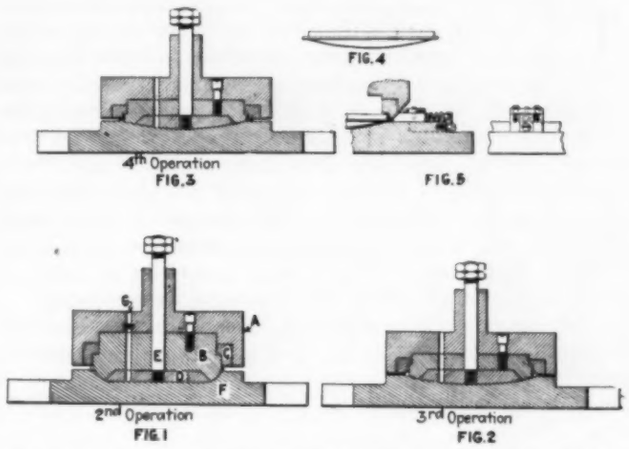
A peculiar thing is that the first pair of rods threaded in this manner were the same diameter as the lathe spindle, and did not require a set of bushings for the headstock.

The sketch shows the rod, bearings, pulley and gear mounted in the lathe headstock.

Dies for Forming a Flanged Cover

BY S. A. MCDONALD

The three dies shown in Figs. 1, 2 and 3 are the second, third and fourth operation dies, necessary to make the cover shown in Fig. 4. The first operation



FIGS. 1 AND 2. SECOND AND THIRD OPERATION DIES
FIGS. 3, 4 AND 5. FOURTH OPERATION DIE, THE FINISHED COVER, AND SECTION OF THE LOCATING PLUNGERS

is done by a standard combination blanking and drawing die, without unusual features.

In the second operation the cast-iron holder *A* contains the center *B* also of cast iron, which clamps the hardened tool steel ring *C*. A machine steel knockout pad D is screwed to the stem *E*. The cast-iron die *F* is turned to conform to the outside, and the punch center *B* and pad *D* are turned to the shape of the inside of the cover as it comes from the first operation die.

This die operates as follows: A cover is placed in the die and when the punch descends, the edge of the tin is piloted by the round corners on the center *B* into the groove between the ring *C* and the center *B*, until it comes up against the shoulder in the ring. At this stage the cover is so confined that it can only bulge out between the punch *A* and the die *F*, as shown in Fig. 1. This bead is the bending point for forming the flange. When the punch ascends the knockout *D* strips the cover from the punch.

The third operation die is similar to the preceding one. The punch center is made to fit the inside diameter of the cover and the die is turned to conform nearly to the finished shape. When the punch descends the ring turns the edge of the cover in until it meets the center, which turns it up until it hits the shoulder in the ring. This leaves the cover in the shape shown in operation three when the punch and die come together. The fourth operation dies flatten the flange as shown.

In the last two operations difficulty was experienced in locating the covers centrally in the dies, due to the small rounding on the corners of the punch center; so three locating plungers, shown in Fig. 5, were made to locate them. The punch is cut away on a bevel to slide the locating plungers back as soon as the cover is located by the punch center. An air hole, as shown at *G*, is necessary in all three dies.

About 15,000 covers were turned out per day on these dies and they came through without a wrinkle.

IN THIS ISSUE

THE leading article describes tools for the manufacture of a mouth organ. As shown in the illustration the completed instrument seems to be simple enough, but we find that there are twenty-five components which enter into its makeup—a comb, two reed plates, twenty reeds and two covers. Its manufacture consists chiefly of press work, and the dies designed are extremely interesting. Strange as it may seem the work on a good mouth organ must be carried on within close limits. Even then a certain amount of hand work, chiefly filing, is necessary when tuning.

The second article, page 376, "Machining the Peerless Upper Crankcase," is the first of several automotive articles which explain the machining operations on the Peerless crankcase, making the ring gear and spider, machining some of the rear axle parts and special fixtures used in the Peerless plant. The first article lists the thirty operations on the upper crankcase in their proper sequence, and details the most essential and unusual of them. The pictures tell more than half the story.

The McCabe economics articles hold our attention through every line and they must be having the same effect on you. They are almost short enough to memorize. The laws laid down and the conclusions reached should not be forgotten, and it would do no harm to memorize such sections as these: "The costs that affect prices most are the costs of new or current products, not the costs that have been incurred for the goods already made. . . . The prices at which goods are offered do not necessarily depend upon what it cost to produce those goods but upon what it is likely to cost to produce other goods of the same kind to meet expected demand." Page 381.

We have been waiting a long time to conclude the Sheldon magnetic chuck series. He was delayed in preparing the last article and then it just naturally got off schedule, but we hope that you will be able to tie it up with the previous installments. This last chapter, page 383, takes up the subjects of supporting pieces of irregular shape on magnetic chucks and testing chucks to determine their classes.

Beginning on page 387 is the conclusion of the first motor service article, "Cylinder Grinding in Motor Repair Shops." It treats of the matter of regrinding, getting right down to basic facts such as production that may be expected, how much feed to use, how much stock to remove, and how to select wheels for the work. There is also a table showing the average prices for regrinding, prevailing in different parts of the country. The next of the motor service articles will appear two weeks hence and will be on the subject of piston grinding.

A recent development in die sinking machinery makes it possible to machine dies of metal using a master of a comparatively soft material such as wood, cement or even plaster. The master is reproduced with only a light pressure against it, while at the same time all of the pressure necessary to carry a heavy cut is applied to the cutting tool. This machine is described on pages 389 and 390.

"Tool Engineering" has now reached the subject of broaching. The article beginning on page 391 takes up the principles of broach and broach fixture design, going into great detail and giving very careful explanation.

A one-page article, page 395, tells how the "Oilgear" hydraulic control has been applied to a press.

The subject of non-productive costs has proved to be one about which many people are thinking. Several weeks ago we had an editorial on that subject. Some of the comment which it aroused from executives is well worth your while. The editorial is reprinted and the comments are given in an article that begins on page 396. We see from the several short articles that non-productive costs are a very large share of the total costs of manufactured goods, and that the importance of keeping them down to a minimum is well realized. One executive says that the productive or direct labor expense was a comparatively small percentage of the whole cost of manufacture and selling; so small in fact that if it had been entirely eliminated the company would not have been able to make enough extra profit to have been considered as belonging to the class of profiteers. Another says, "The wise manager who has an excessive overhead will begin to turn off the excess in that overhead with a very drastic knife before his competitors force him to do it."

Coming Features

Effect of Heat-Treatment on Steel Castings and Drop Forgings—A. A. Blue.

Machining the Peerless Lower Crankcase and Front Cover—Fred H. Colvin.

Characteristics of the Forged Milling Cutter—William G. Calkins.

Tools Used in the Manufacture of P & W Adjustable Limit Snap Gages—Ellsworth Sheldon.

Economics of Production (IV)—Prof. D. A. McCabe.

Organization and Management of the Small Shop (V)—Elmer W. Leach.

Modern Production Methods (XXI)—W. R. Basset.

All of the articles listed above will be in our next issue.

EDITORIALS

Importance of Proper Cost Accounting

THE present depression has actually been a benefit to certain phases of business and industry in that it has emphasized their importance. The example which we have in mind is cost accounting. Although the idea of its value has been high and has steadily risen, the need of even more information regarding costs is making itself felt.

When business is very good it is not generally thought necessary to know every detail of costs, as the price can usually be placed at a safety point. When competition becomes very keen, however, prices go so low that profits are sacrificed. Then it is that the concern having the fullest and most reliable information regarding its costs is the best equipped to bid safely for business.

Even when doing a greatly decreased volume of business, most concerns have not found it advisable to reduce the staff of the accounting department. On the contrary, cases have been pointed out to us where it has actually been increased recently. This may be due in part to the same reason that we see so many firms keeping practically all of their office force busy and only a part of their plant. The volume and the value of the business has been reduced, it seems, but not the amount of detail required for carrying it on, as it takes about the same time to write an order for one file as for a gross of them.

Cost accounting is a subject having such wide ramifications that we shall not attempt to go into detail. Of course, the nature and the thoroughness of the accounting depend upon the purpose for which it is carried on, whether for price fixing, or for the determination of the profit or of the efficiency of the production department. But, in order that cost accounting may become a more useful art and science, so to speak, considerable standardization in terminology and definitions of fundamental principles is necessary. At present, the Industrial Cost Association is working upon the matter. At a convention held at the end of last May this association discussed the matter of standardization of terminology as well as other matters, notably those relating to uniform cost systems.

By a uniform cost system is meant the use of the same method of accounting throughout an entire industry, or in all similar plants. It is thus possible to compare the costs of similar operations in various plants, with the object of finding the leaks that may occur in some of the plants. The idea has been proved successful in several fields, notably the textile-making industry. An organization of firms doing similar work must, of course, sponsor the plan. It would be a surprise to many of us to know that cost data are freely exchanged among concerns, even the names of firms being given in many cases. Note, however, that the exchange of costs does not enter as a basis for the fixing of selling prices, and uniformity of method, not necessarily of price, is obtained.

Another live problem for the cost accountant is the question of how to handle abnormal burden. Since the burden rate varies quite appreciably in good and bad times, the method of handling it is difficult. Each concern usually determines by experience what it calls its "normal" burden. But what to do with abnormal burden charges which appear when the plant is running at only part capacity is a real problem. Ordinarily these costs are distributed over the entire year, but now many plants include abnormal burden in the current monthly cost. There are arguments for both ideas, of course.

Some accountants say that since it is the ultimate or average cost which counts, costs should not be figured for monthly periods, or even yearly periods in some cases. The monthly cost is usually too fluctuating to permit of setting stable selling prices. The best argument for including all of the abnormal burden in the month in which it occurs is that it gives a more accurate statement of the true conditions. In periods of depression when nothing but a loss is expected, why not show it on the books, rather than carry over the burden to penalize future operations?

Assistant President of the United States

IT HAS been currently reported in the daily press that proposals have been made to the joint committee on reorganization in Washington to create an office that would virtually be an Assistant Presidency of the United States. The suggestion is to appoint an executive secretary who will have much broader powers of initiative and decision than those granted to the President's secretary and that he be assigned the duty of supervising, on behalf of the President, the executive departments of the Government, and to give attention to such matters of minor detail as now encroach on the President's time.

Why create a new office for a new incumbent? What is the matter with having the Vice-President fill the position and do what he can to assist in the operation of the Government? Is not that what he is paid for? The days when vice-presidents in business life were figureheads has passed. In every large business corporation specific duties are assigned to the vice-president.

While the Vice-President of the United States has always been more or less of a figurehead, the time has come when he should be of some real use—and President Harding promised that the present incumbent should be.

Especially in times of stress, such as we are now passing through, it is up to every officer of the Government to assist in making his work as efficient as possible.

In the interest of economy and efficiency, put the Vice-President to work.

Automobiles and Ice Cream

SAMUEL GOMPERS is reported to have said that every worker is entitled to an automobile and to ice-cream. We agree—when they earn them. And this applies to everybody else as well.

Shop Equipment News

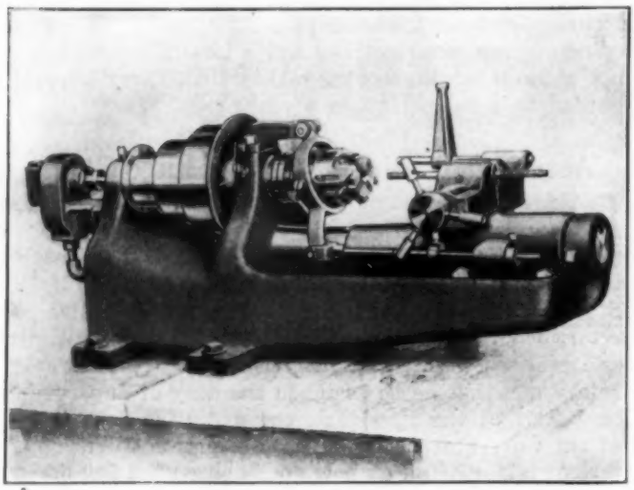
Geometric Bench Threading Machine

A bench threading machine, shown in the illustrations herewith, for use in threading small work has been placed on the market by the Geometric Tool Co., New Haven, Conn.

The machine is fitted with a Geometric rotary die head which will cut threads of fine pitch on ⅛ to ¼ in. diameters, inclusive.

The bed of the machine consists of a single casting, carrying a spindle mounted on liberal sized bronze bearings. The spindle is driven by a three-step cone pulley and carries a Geometric self-opening rotary die head, which is operated by a yoke lever and trip rod. Adjustable stops, arranged on the trip rod, govern the point of opening and closing the die head.

The carriage is equipped with a two-jawed chuck, which is operated by a handwheel. Collets, expanding

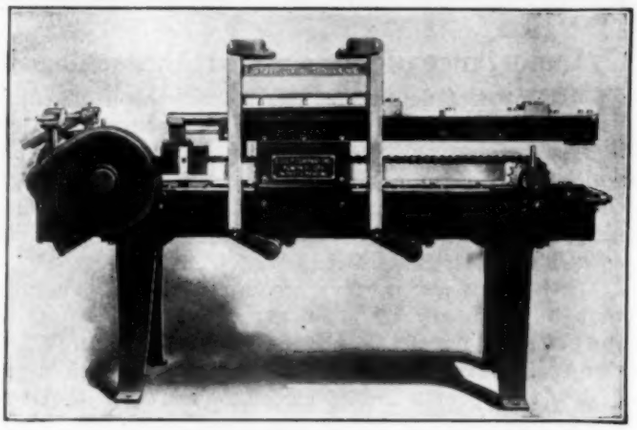


GEOMETRIC BENCH THREADING MACHINE

arbors or special holders can be furnished if the work requires. The carriage travels on a round shaft and is guided by a large bronze key, which engages a keyway on the shaft. This construction allows the maximum space for the removal of chips from the bed of the machine. A geared pump with direct drive from the spindle forces oil from the reservoir in the bed of the machine through the spindle and against the work. The machine is arranged for bolting to a bench, or it may be mounted on a separate pedestal, which will be furnished on request.

Stolp Automatic Lockseaming Machine

A lockseaming machine which is claimed to be a departure in this field has been developed by the Stolp Company, Geneva, N. Y. The machine produces lockseamed articles direct from the blank without an extra operation, and it is also equipped with a self feeding attachment by which lockseamed tubes can be produced direct from a coil of metal. It will lockseam tubes of any thickness of metal and will lockseam taper tubes within certain limits. The machine can be used for the

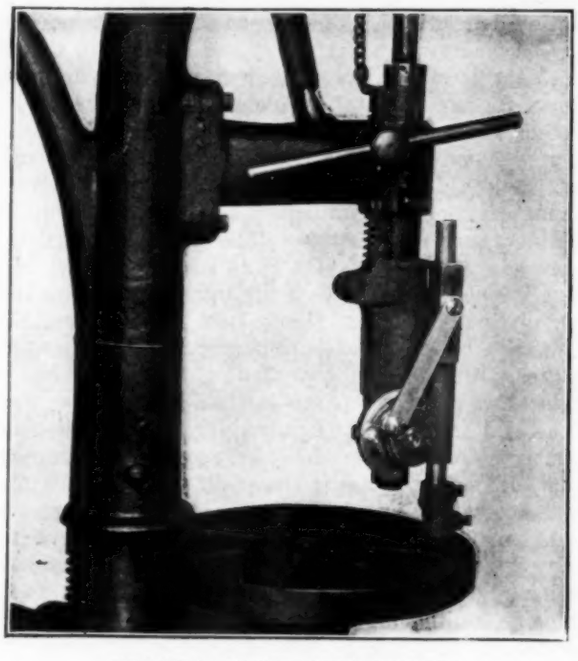


STOLP AUTOMATIC LOCKSEAMING MACHINE

manufacture of tin cans and metal containers of all kinds, mailing tubes, pipes of all kinds, muffler tubes, radiator tubes, shade rollers, pump cylinders, and other articles of this nature.

Utility Filing Attachment

The Utility Tool and Manufacturing Co., 2717 Lafayette Ave., St. Louis, Mo., has brought out a filing attachment that was designed for application for drilling machines. It consists of a housing which slips on to the spindle sleeve, the housing containing a pair of bevel gears which operate with the machine spindle. To one of the gears is attached a crank that operates a lever, which in turn drives a small shaft up and down. The file is attached to the lower end of the shaft. It is said that the attachment can be applied to any make of machine within one minute and will accommodate any



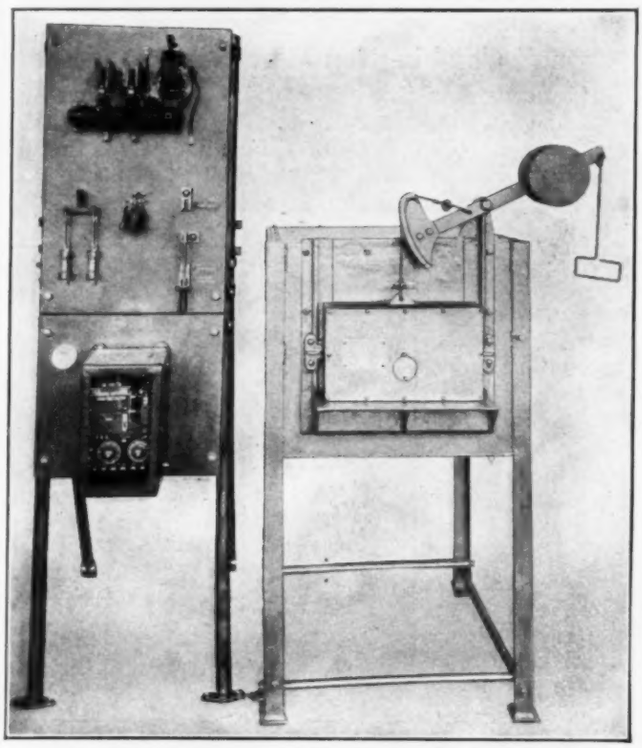
UTILITY FILING ATTACHMENT

shape of file from the smallest up to 16 in. It is also said to be adaptable for either heavy duty or small die work, and to be adjustable for any angle from 1 to 90 deg. The attachment is of heavy construction and the gears are of steel, hardened and ground. Bearings are phosphor bronze.

General Electric Small Resistance Furnace

The General Electric Co., Schenectady, N. Y., has developed an automatic furnace, known as the semi-cylindrical type. This furnace, which is said to possess many improved features in design and construction, is primarily designed for operation at 1,800 deg. F., although by removing the temperature limit fuse it can be safely operated at 2,000 deg. F.

The complete equipment consists of the furnace, transformer, automatic control panel and a temperature



GENERAL ELECTRIC SMALL RESISTANCE FURNACE

control instrument which is mounted on the sub-base of the panel. The furnace consists of a large sheet-steel casing, supported on legs, lined with insulating material, and having a semi-cylindrical chamber.

The heating element consists of a continuous strip of resistor ribbons formed into an arch, or succession of semi-circular turns conforming to the arch of the furnace chamber and extending the whole length of the latter, the proper spacing between turns being maintained by means of insulators. This gives a winding which is self supporting yet still flexible to expansion and contraction. The two ends of the winding are brought out at the back wall of the chamber, so that the cables of the power supply may be attached. The heat is radiated direct to the charge, and the absence of a muffle allows a lower temperature gradient, as no heat has to be forced through it to reach the charge. Also, since the resistor is of large cross-section, the combination of the two factors allows a high power impact for the heating-up period.

The spacing of the resistor ribbon is said to aid in the heat distribution of the furnace. The whole heating unit can be pulled out bodily for inspection or repair by removing the front of the furnace and disconnecting the terminals at the back. The transformer, which is mounted on the pipe frame of the control board, has four primary coils, insulated from the secondary. The coils may be connected in multiple, multiple-series, or series, for 110, 220, or 440 volts respectively, at 60 cycles. The secondary has two taps, one 70-volt giving 10 kw. for rapid heating; the other 50-volt giving 5 kw. for normal operation. The transformer is rated 7.5 kw. normal, but will give 10 kw. for short periods such as mentioned above. The time required for heating is 1½ to 2 hours, depending on whether or not the furnace was used the day before.

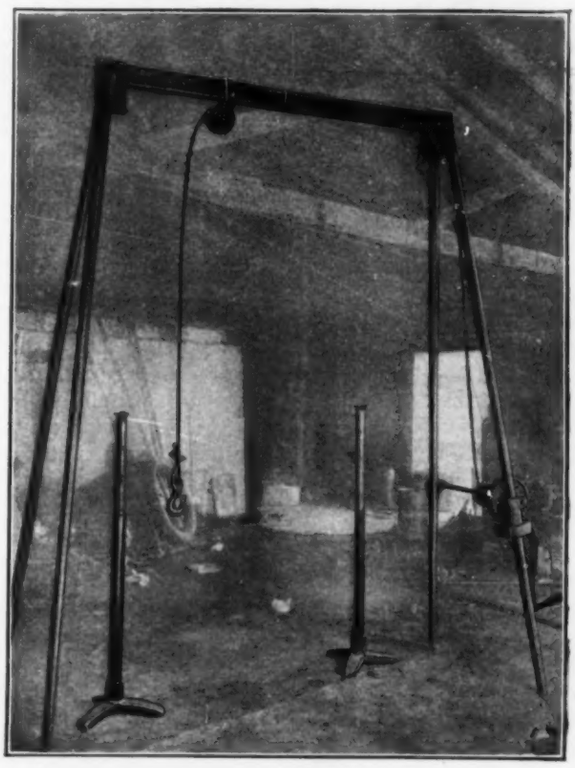
Kimball Portable Garage Crane

The illustration shows a portable crane recently developed by Kimball's Garage, 139 Ashmun St., New Haven, Conn. It is for use in garages or upon the road wherever it may be necessary to lift all or any part of a wrecked or dismantled car.

The legs of the crane are of standard wrought-iron pipe. They fit into welded steel brackets that are attached to the ends of the crossbeam by means of taper pins and they may be of any length desired. The crossbeam is a standard I-section of structural iron and is furnished either 4 or 6 in. in depth according to the service for which the crane is required.

The hoisting apparatus is a complete unit, consisting of a winding drum and wormwheel cast in one piece and of a worm and crank handle which are supported by a bracket on one of the legs. A bar of cold-rolled steel passing through this and a corresponding bracket upon the opposite leg holds the whole in place and it may be set at any convenient height from the ground.

The wire hoist rope passes over a sheave that is



PORTABLE CRANE FOR ROAD AND GARAGE USE

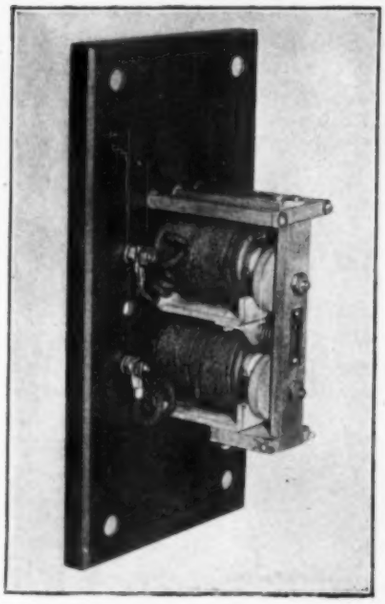
supported by a wrought-iron yoke encircling the beam. The yoke is so shaped that, though it may easily be moved in either direction along the beam when there is no load upon the rope, it grips the beam firmly in whatever position it may be left when the strain is applied.

The long jacks are supplied as a part of the equipment and are used as temporary supports whenever it is desired to support any part of a car in an elevated position.

The whole apparatus may be assembled and disassembled by two men in five minutes, and when down may be loaded into the back of an ordinary delivery wagon with only the legs projecting.

G. E. Voltage-Drop Relay

The General Electric Co., Schenectady, N. Y., has placed on the market a type of control for direct current motors, for either reversing or non-reversing applications. It is intended to combine time and current limits, allowing high torque where necessary, and minimizing current peaks on light loads. The system is known as the voltage-drop system, from the fact that the relays which control the accelerating contactors are operated by the voltage drop across the motor's starting resistor. Since the voltage across the starting resistor is proportional to the current in the resistor, the system gives a form of current limit control. The system is said to be best suited for motors that are subject to frequent starting and stopping, and that are required to operate under varying conditions of torque and load.



GENERAL ELECTRIC VOLTAGE-DROP RELAY

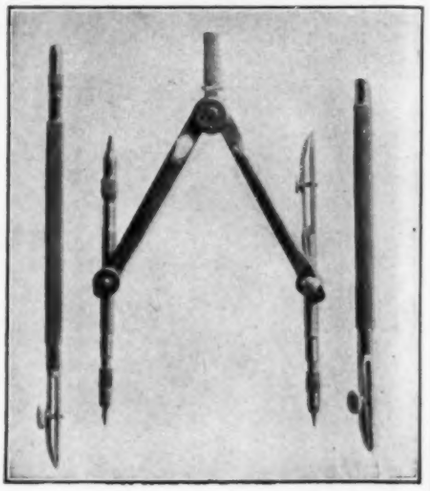
The voltage-drop relay, shown in the accompanying illustration, has two independent magnetic circuits, the upper one energized by a calibrating coil and the lower one energized by an assisting coil. A compression spring normally holds the relay contacts closed. Both coils of the relay are energized to open the relay contacts, but in actual practice the lower, or assisting coil, is short-circuited by a contactor. The voltage at which the armature will close the contacts may, therefore, be adjusted by means of the upper adjusting nut.

The relay possesses a small time lag in the releasing of the armature after the assisting coil is shorted, caused by the self induction of the shorted coil creating a relatively slow decrease in the magnetic flux. The lag may be varied from approximately 0.05 to 0.3 seconds, but it does not affect the calibration of the relay as a whole, as fixed by the calibrating coil adjusting nut. Thus, the relay may be set to close the contactors at a relatively high value of current when the motor is heavily overloaded, and still prevent high current peaks when it is accelerated under light loads. The small time lag permits the motor's speed to rise enough between the closing of one contactor and that of the next, to reduce the peaks for light loads. It is said that the heating of the starting resistor, which changes the resistance of the resistor, and the voltage drop across it, is nearly balanced by the heating of the relay coil due to the passage of current.

Only one size of coil is required for all sizes of motors of the same voltage, making relays interchangeable, including the coils. The relays are entirely separate from the contactors, and can be mounted in a group on one corner of the panel and covered. Since the contacts never break the circuit, they are not subjected to burning. The relays, in conjunction with shunt contactors, have been applied to standardized panels, for the control of various types of motors.

"Cyma" Combination Compass and Divider

The illustration shows the "Cyma" combination compass and divider, made by the Tavennes Watch Co., Switzerland, and marketed in the United States through Edgar Bourquin, 1347 Main St., Waltham, Mass. Four tools—two divider points, a lead and a pen—are included in the construction of the instrument, as shown. Any of the four tools can be brought into play, thumbnuts being provided to lock the legs in the position desired. The divider points are claimed to be strong enough for inscribing on metal, and reversing these points produces similar points for use on the drawing board.



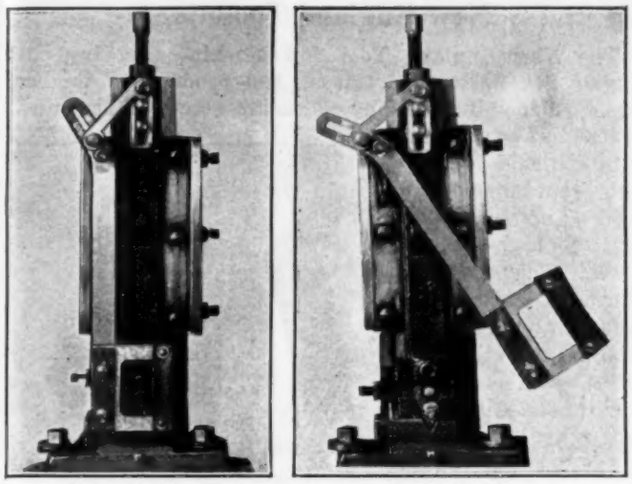
"CYMA" COMBINATION COMPASS AND DIVIDER

It is said that the various joints and fulcrums are perfect fits and that they can be rigidly locked. The illustration also shows a "Cyma" combination ruling pen and pencil point, and a "Cyma" single ruling pen, which are made and marketed by the same people.

Woodward and Wolf Press Guard

The accompanying illustration shows a safety guard recently placed on the market by Woodward & Wolf, 21? Rosemont Ave., Trenton, N. J., for attachment to small foot-actuated presses. At the beginning of the stroke of the press the guard is well out of the way, where it cannot interfere with the placing or removal of the work.

When the press begins its downward stroke, the guard is said to swing well across the danger zone in only ⅛-in. movement of the punch or upper die, so that the hand of the operator will be removed before the punch descends, should the hand be in a dangerous

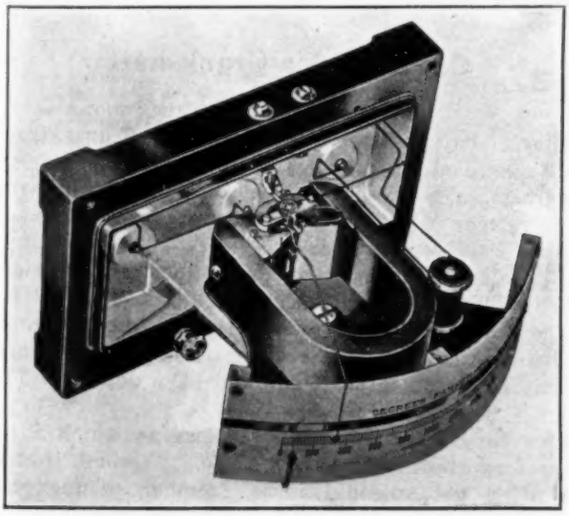


WOODWARD & WOLF PRESS GUARD

position. The view on the left shows the guard in a position in front of the die, while on the right the guard is at the limit of its stroke, the punch being at the bottom of its travel. It is claimed that the operator cannot work around or back of the guard. The position of the guard can be readily changed to operate either clockwise or anti-clockwise, for either right- or left-handed operators.

Brown Compensated Pyrometer

The Brown Instrument Co., Philadelphia, Pa., has placed on the market a thermo-electric pyrometer which is automatically compensated in the instrument for changes in cold junction temperatures and which includes means for setting the pointers of the instrument to zero in the usual manner. No cold well in the ground nor compensating box is necessary with this instrument. It is only necessary to bring the compensating or extension leads from the thermo-couple to the instrument. After mounting the instrument, the instrument pointer is set by the zero adjuster to correspond with the index on the scale. If the values for a thermo-couple have been determined based on a cold junction of 75 deg. F., the index will indicate 75 deg. F., provided the instrument is subject to that surrounding temperature. If the instrument pointer does not correspond with this index, it is set accordingly. When the temperature surrounding the instrument and the cold junction of the ends of the compensating leads at the instrument rises to 90 deg. F., the index automatically rises to 90 deg. F., and the Briguet spiral attached to the instrument pointer causes it to move up to 90 deg. F., automatically adjusting for the temperature of the cold junction of the thermo-couple.



BROWN COMPENSATED PYROMETER

It will be understood that any number of thermo-couples with their extensions or compensating leads can be brought to the one instrument having this automatic compensation. Likewise, recording instruments can be equipped with this automatic compensation and means for setting the pointer to zero.

Hilliard Ball-Bearing Clutch and Cut-off Coupling

The Hilliard Clutch and Machinery Co., Elmira, N. Y., has developed a ball-bearing sleeve clutch, which is of the same general design as the standard Hilliard clutch with the exception that the sleeve is extended and contains Fafnir ball bearings of the annular type. The use of the ball bearings is for high-speed purposes, as many clutches are used for speeds up to 2,000 r.p.m. Ball bearing sleeves are said to insure that the sleeve member will be kept at all times in proper alignment with the other member, which keys to the shaft, and also that the friction surfaces will at all times be in proper relation to each other. The bearing caps are

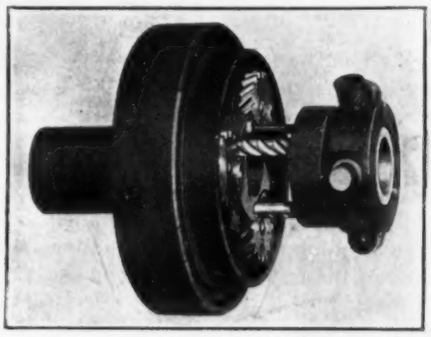


FIG. 1. HILLIARD BALL BEARING CLUTCH

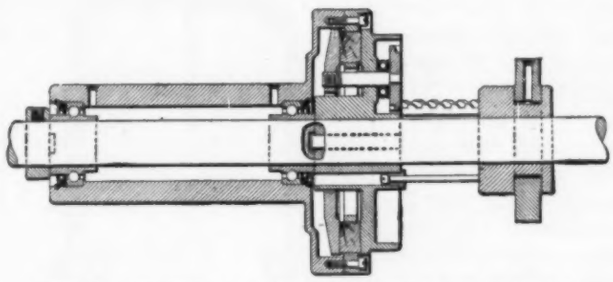


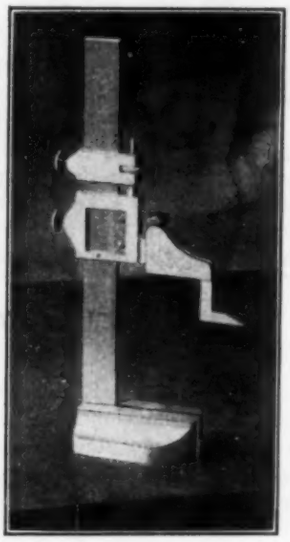
FIG. 2. SECTIONAL VIEW OF HILLIARD CLUTCH

fitted with felt washers which exclude dust and retain the lubricant. These ball bearings are said to reduce friction loads to a minimum, prevent wearing the shafts, and need lubrication only three or four times a year. A general view of the clutch is shown in Fig. 1, while the sectional view in Fig. 2 shows the construction.

Fafnir ball bearings are also used in the Hilliard high-speed friction cut-off couplings, for use in connection with high-speed gas engines for driving centrifugal pumps, blowers, air-compressors, etc. Perfect alignment between the driving and driven shafts is of importance, and such alignment is said to be insured by the use of ball bearings. The cut-off couplings are made for shafts 1 7/8 to 3 1/8 in. in diameter.

Art Tool Co. Base Block for Vernier Height Gage

The Art Tool Co., 16 Montgomery St., Bridgeport, Conn., has placed on the market a base block designed to hold vernier calipers or height gages in an upright position when using them for laying out or testing work upon a bench plate. The blocks are made of carbon steel and are ground and finished all over.

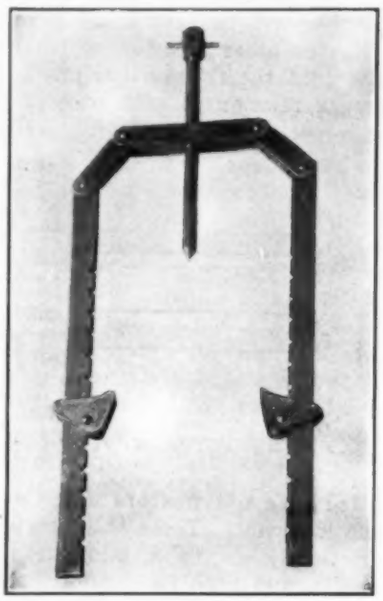


BASE BLOCK FOR HEIGHT GAGE

A groove of rectangular section passing lengthwise through the upper side of the block is fitted to take the thick jaw of a standard height gage so that no packing pieces need be used, and the sides as well as the bottom of this groove are machined with great care so that the instrument will stand square with the base in both planes. A flat sided taper key passes through a correspondingly shaped hole that intersects the groove, and pressure is applied to this key by means of a headless screw on the under face of the block so that a firm grip is secured upon the gage without danger of marring it and without projecting screws to interfere with its use.

Art Tool Co. Diemaker's Clamp

A clamp for holding die and punch together when scribing or "offsetting" the latter, is being made by the Art Tool Co., 16 Montgomery St., Bridgeport, Conn.



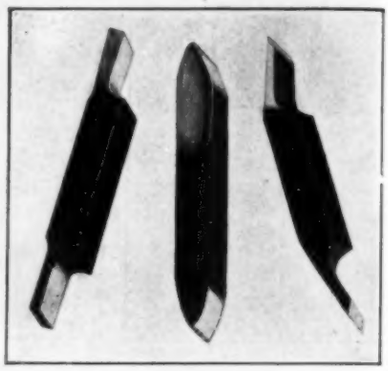
CLAMP FOR DIEMAKER'S USE

This is an elaboration of the tool that every diemaker usually constructs for himself and possesses added advantages in the way of adjustable toes for accommodating punches of different heights, as well as toggle joints in the crossbar to permit the tool to adapt itself to varying widths. There are no screws or loose pins in the toes. These are free to be moved up or down when no work is in the clamp and will hold firmly against the pressure of the screw when the permanently located pins fall into any of the notches upon the bars.

The clamp is made of mild steel, casehardened and left in the natural color. It will be found adaptable to a wide variety of uses by the toolmaker.

New England Toolbits

The New England Tool and Machine Co., Inc., 51 Taylor St., Springfield, Mass., has produced a line of standard toolbits, some of which are shown in the illustration. The toolbits are said to be cut from annealed bars of highest quality high-speed steel. They are formed, hardened and ground to standard shapes, with standard clearances. Cutting edges are provided on both ends. It is intended that a supply of these toolbits be kept in the toolcrib and checked out to the operators. This is intended to conform with modern methods which provide for the use of standard tools and do away with tool-grinding on the production floor. The line includes R. H. diamond points, L. H. diamond points, R. H. side tools, L. H. side tools, round-nose tools, U. S. Standard thread tools for all pitches, V-thread tools and cut-off tools. The sizes furnished are $\frac{5}{16}$, $\frac{1}{4}$, $\frac{7}{16}$, $\frac{3}{8}$, $\frac{7}{16}$ and $\frac{1}{2}$ inch.



NEW ENGLAND TOOLBITS

Scrapers Quickly Made

BY R. MCHENRY

I find that very satisfactory scrapers may be easily made from worn-out blades of a power hacksaw.

The saws used on these machines are of the heavy type, hardened throughout, of about $\frac{1}{16}$ in. thickness by 1 in. wide, and 14 in. or more in length.

The ends are first snapped off to allow for a tool 11 in. long. The toothed edge is then ground smooth and the width narrowed slightly to within an inch or so of each end. These ends are now shaped at the grinding wheel to suit the work in hand. Also the sides should be dressed lightly near the cutting edges to remove the scale.

The result is a hard flexible scraper, a set of which made up of different varieties will require but little space in a toolkit.

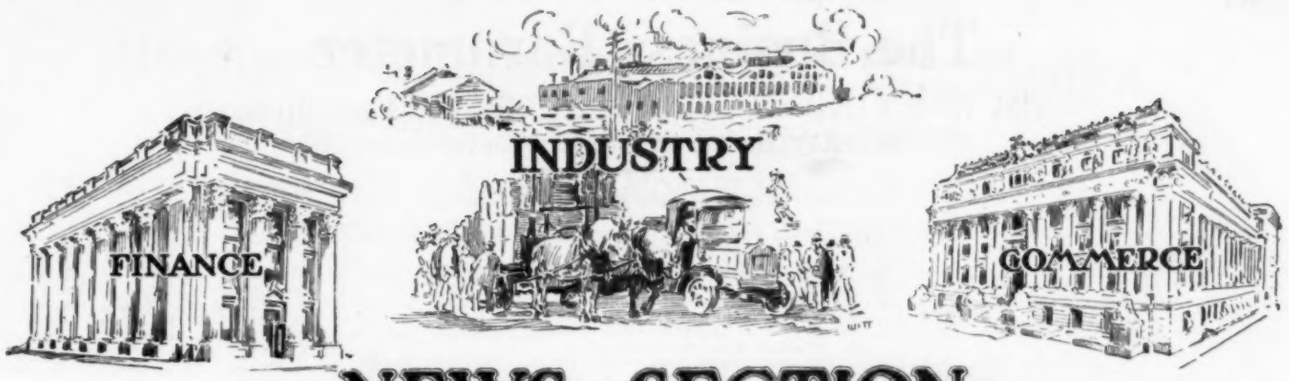
Cutting Off a Crankshaft

BY F. E. ERVIN

Elias J. Parks' experience in cutting off an extractor shaft, detailed on page 920, Vol. 54, of *American Machinist*, calls to mind a method used in a similar case by a farmer who had recently purchased a gasoline engine.

He desired to replace the plain pulley with a friction clutch pulley and it was necessary to cut off about 6 in. of the crankshaft. He simply started the engine and used a common hacksaw, cutting off a $\frac{3}{4}$-in. shaft about as smoothly as a lathe tool would have done it. Time, about $\frac{1}{2}$ hour.

This taught me two valuable lessons which I have never forgotten: First, how to do it; second, that you can often get splendid ideas from most unexpected sources.



NEWS SECTION

Industries Confer With Census Bureau

At the request of Commerce Secretary Hoover, representatives of industries gathered in Washington July 29 to discuss methods of bettering the next census of manufacturers. At that meeting, a committee was appointed to make specific recommendations. The first of these recommendations, as outlined below was made last week. Those present at the meeting were Nathan B. Williams of the National Association of Manufacturers; W. Compton, the National Lumber Manufacturers Association; H. C. Morris and W. D. Brookings, Chamber of Commerce of the United States; B. M. Price and Pyke Johnson, National Automobile Chamber of Commerce; W. D. Biggers, American Hardware Association; Paul T. Cherington, National Association of Wool Manufacturers; L. M. Fanning, American Petroleum Industry; Albert E. Marshall, Chemical Division of the American Engineering Council and Allan H. Willett, of the National Coal Association.

In suggesting improvements in the gathering of industrial information by the Bureau of the Census, the committee representing the industries, has suggested that no effort be made to collect statistics from establishments having an annual output of $5,000 or less. Heretofore the census has sought returns from every establishment having an annual output exceeding $500 in value. The committee also discussed in detail the draft of the schedule proposed by Director Steuart, of the Census Bureau, for the 1921 census of manufactures. No public discussion of these schedules will be undertaken at this time.

These representatives of the industries, who met with the Commerce Department officials, emphasized the need of preventing duplication in government questionnaires and statistics. Another important point made at the conference was the need for greater safeguards to prevent the disclosure of individual returns.

Louisiana Manufacturers Perfect Organization

With an attendance of over one hundred and fifty manufacturers at its first meeting, the Louisiana Manufacturers Association was organized on Aug. 26, at New Orleans. The association was formed for the purpose of safeguarding the interests of manufacturing industries throughout the state by co-operative methods which will enable these industries in the proper way to appear before the legislature and other lawmaking bodies and voice the united sentiment of the manufacturers on questions of law which affect their business. The meeting was addressed by several prominent business men of Louisiana.

The election of officers resulted in the following being chosen: Wilmer Johnson, president; Charles H. Behr, first vice-president; Dr. W. D. Hass, second vice-president; S. Odenheimer, third vice-president; Peter Jung, Jr., secretary-treasurer.

Auto Taxes Increasing

An analysis of the tax collections during the fiscal year ended June 30 shows that the levy on automobiles produced $115,545,760.38. This shows a decrease from the preceding fiscal year when $143,922,792.01 was collected.

P. M. Fowl, President of Cadillac Tool Co., Dead

Percy M. Fowl, president and general manager of the Cadillac Tool Co., Detroit, Mich., died on August 24, following an operation for appendicitis. Mr. Fowl was thirty-eight years old.

He was born at Elyria, Ohio, where he received his early education and training. After working in several plants in and near Elyria, he came to Detroit in 1907, where he was employed at the Ford plant and also at the Burroughs Adding Machine factory. Later he became associated with Strong, Carlisle & Hammond as a salesman and it was in this capacity that he became a popular figure in the machine tool industry.

PERCY M. FOWL

In 1917 he became president and general manager of the Cadillac Tool Co. and continued in that position until his death. Mr. Fowl had a legion of friends in the machine tool industry who deeply mourn his death.

He is survived by his wife, Alice MacLean Fowl, and a daughter, Marjorie Ann; also by his father, a sister and a brother.

Hearings on Metric Bill

A sub-committee of the Senate Committee on Manufacturers has been designated to conduct hearings on a bill by Senator Ladd, of North Dakota, providing for the compulsory adoption, after ten years, of the metric system of weights and measures. Senator McNary, of Oregon, will act as chairman of the sub-committee. The other members are Senator Weller of Maryland, and Senator Jones of New Mexico.

It is the intention to have limited hearings shortly after the congressional recess, so that the proponents and opponents of the legislation may state their views as to the desirability of such a law. It then is the intention to circulate as widely as possible a stenographic record of the hearing, with the idea of acquainting the public with the problems involved. Later, during the regular session of Congress which begins in December, it is planned to have further hearings, after which an attempt will be made to secure favorable action by the committee, thereby securing a place for the bill on the Senate calendar where its consideration would be taken up in due course.

To Resume Manufacture of Marlin Firearms

A new corporation, known as the Marlin Firearms Corporation, has purchased the former Marlin Firearms plant, at New Haven, Conn., and has acquired all of the machinery, tools, fixtures, gages, patents, good-will, inventory, etc., of the Marlin business, which has heretofore been conducted by the Marlin Firearms Co. and the Marlin-Rockwell Corporation.

The business was originally established in New Haven by John M. Marlin, in 1870, and was carried on successfully by the Marlin family until 1916, at which time the plant was acquired by the Marlin-Rockwell Corporation and used principally for the manufacture of machine guns throughout the war, these plants being recognized as the largest producers of machine guns in the world. The new corporation will manufacture the full Marlin line of repeating rifles and repeating shotguns; also single-shot rifles, single guns, double-barrel guns and revolvers.

The work of reorganization is already under way and the company expects to progress rapidly, re-establishing the business so that within a short time the plant will be able to operate with a full force in regular production. The factory organization includes all of the important men of the old Marlin firearms organization—practical gun makers with from 15 to 20 years of experience in the manufacture of high-grade firearms. These men, combining their experience in making sporting firearms with that of producing automatic machine rifles and guns and other firearms, insure that the new Marlin firearms will be in every way equal to, or even superior, to the Marlin products manufactured by the old company.

The officers of the new company are: John F. Moran, president; LeRoy Sargent, vice-president; Reuben Hill, secretary and treasurer. The directors are these officers with Howard E. Adt and Thomas M. Steele. Mr. Moran has been for twenty years associated with the Marlin Firearms and Marlin-Rockwell interests.

Automotive Engineers Plan Big Session in January

The Society of Automotive Engineers has announced that its annual meeting will be held in New York City, January 10 to 13. This follows the established custom of holding the meeting during National Automobile Show week when interest in the industry centers in the eastern metropolis. The S. A. E. dinner, which has become established as one of the most representative assemblies of automotive men during the year, will be held Thursday, Jan. 12. The celebrated S. A. E. carnival is set for the night preceding the dinner, Jan. 11, and the meetings committee is busy arranging details for both of these events even at this early date.

The plans for the technical session are developing and indications point to the arrangement of a very comprehensive and educational program.

The meetings committee suggests that members desiring to present papers communicate with the society offices at 29 West 39th St., New York, without delay, since it is desirable that the acceptance of all manuscripts be decided by Oct. 1 in order to provide sufficient time for preparation and circulation of the preprints.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

Copyright, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York

The outstanding feature of the week is a mild revival of speculative confidence and even the conservatives who decry speculation are a little more cheerful because people are becoming normally hopeful again.

The speculative activity has thus far been confined to the cotton market, but there are signs that it is spreading for prices have stopped declining, the bears have been trying to cover and people everywhere are beginning to ask, "What shall I buy?" instead of advising each other to sell.

It is true that in cotton the advance of two or three cents a pound recorded during the week is due to a reported crop disaster that is without precedent, but it is unlikely that the trade demand would have lifted prices so sensationally if the speculative spirit had not been latent and inflammable. In just what quarter it will next manifest itself no one can say. It may be in grain, coffee, sugar or securities. In none of these markets is the position more bearish or the outlook for an advance less encouraging than was the case in cotton a few months ago.

Meantime I observe with some satisfaction that nearly every one is coming to share my persistent optimism in regard to the autumn trade. In a published advertisement the nationally known contractors, J. G. White & Co., say that "A trade revival is indicated by reports received from practically all the principal industrial centers."

A letter from Philadelphia in the *New York Evening Post* says, "For the first time this year consumption exceeds production." The *Credit Guide* says, "For the fifth consecutive week business shows improvement and greater activity on the part of the retailer." A St. Louis bank after an exhaustive canvass of the Middle West by questionnaire reports that there is no ground for pessimism and as yet none for excessive optimism.

Otto H. Kahn, just back from Europe, is quoted as saying that "We shall soon find ourselves within sight of prosperity" and the *Credit Clearing House* is statistically cheerful in reporting that the money value of the wholesale trade for the week ending Aug. 26 was only 2.2 per cent under last year, while the percentage of decline in prices is from 25 to 35 per cent.

There are many other straws which show that the stream of business is flowing with increasing force. Among them is a better demand for coal. Another is a continued improvement in the inquiry for steel and iron. A third is an advance in copper to 12 cents a pound and a fourth is to be found in a report of the Geological Survey which states that the shipments of Portland cement for the first seven months of 1921 are within 4 per cent of last year's record. The Federal Reserve banks and Board are almost alone in doubting the imminence of a trade revival but their dubiousness is to some extent offset by the figures of the department store trade for July in the twelve reserve districts.

These figures show an average decline of but 15.1 per cent in the money value of retail sales throughout the country. Commenting on them the *New York Journal of Commerce* says, "Prices have beyond doubt fallen as much, and it is therefore reasonable to infer that the volume of goods moving over our counters is as great if not greater than last year." From this it is argued with truth that "the current assertions about the number of unemployed and the consequent impairment of the country's purchasing power are gross exaggerations."

As to the alleged unemployment of which so much is heard and so little is seen, at least in and around New York, it is to be noted that President Harding has called a conference to consider it, to be held in Washington in September. It is not clear what such a conference can accomplish unless it recommends that employment be provided at public expense upon public works as is already being done in Racine, Wisconsin, and Detroit, but President Harding is nevertheless to be commended for his promptitude in action and the many efforts he has made and is making to keep industry on the even keel of sustained activity. If Congress would but co-operate with him more heartily by making the promised readjustment in taxes most of the uncertainty by which business is restrained would disappear.

Senator Smoot has given notice that he will introduce a substitute revenue bill as soon as Congress reconvenes. It seems to be a great improvement on the House bill now pending. Briefly, it repeals the present law but re-enacts the existing inheritance and tobacco taxes and provides for an income tax with surtaxes not in excess of 32 per cent, a 10 per cent tax on the net profits of corporations and a 3 per cent manufacturers tax to be imposed only on manufactured articles when they are first sold so that it cannot be passed on by the jobber or retailer. The very simplicity of the proposal makes it attractive and it is to be hoped it will receive serious consideration.

The domestic news relating to business is otherwise unimportant. The stock market has been quiescent and the bond market firm. A loan of $25,000,000 to the Republic of Brazil on an 8.15 per cent basis and another for $7,500,000 to Uruguay offered to yield 8.20 per cent have been well taken. The readiness with which these and other foreign loans have been placed seems to indicate a broadening demand for foreign securities in the United States.

Railroad earnings and car loadings continue to improve. Preliminary figures for July indicate that the net revenue for that month will approximate $75,000,000. This will almost equal the average of the three years ending June 30, 1917, which was the most prosperous period of American railroad history. This is the more remarkable because the high freight rates are diverting much transcontinental traffic to the Panama route. A despatch from Portland, Oregon, says that thirty million bushels of wheat carried by 100 huge steamships will leave there this winter. Much of this grain, formerly carried by rail, will come to the Atlantic Coast.

In the Pacific Coast lumber trade there is a similar diversion of traffic, for during the first half of 1921 there were 93 million feet of lumber shipped by water to the Atlantic Coast as against only a million and a half in 1920. The railroads are endeavoring to meet this competition by reducing transcontinental rates but no reduction has as yet been made in rates to and from inland points where there are no competing steamships to carry the freight. Even Henry Ford has been finally forbidden to reduce rates on his own road, but he has cut the price of his automobile to the basis of $355 for the touring car.

Professor Ripley of Harvard, now associated with the Interstate Commerce Commission has submitted a tentative plan for the remaking of the American railway map which contemplates grouping the various roads in twenty great systems. Thus far the scheme is admittedly academic but in time something of the kind must become a reality and the suggestions made will repay careful study.

The statement of the Federal Reserve Banks shows a further gain of $22,000,000 in the gold held and a reserve ratio of 66.8 per cent as compared with 66.5 the week previous. It is difficult to believe that this constant increase in the gold supply can much longer be without effect upon values as expressed in terms of gold.

All foreign exchanges except marks are higher. The advance is explained by reference to the German reparation payments but no one really understands it. The decline in marks is, however, plainly due to the fact that too many marks have been printed. It may also be in part due to the political unsettlement reported from Germany following the murder of Erzberger. There is, however, nothing to indicate that the political stability of the German Republic is seriously threatened.

The Irish question is still in the air but the rioting in Belfast is not reassuring to those who hope that Ireland will some day be entirely tranquil. Seemingly that is impossible. The East Indian uprising in Malabar is apparently becoming a vary serious affair and the "private war" between Greece and Turkey is still in progress but the London Stock Exchange is unperturbed. Prices are rising, money is easier and the rate for call loans has fallen to 2 per cent. Old John Bull is certainly a phlegmatic character for most people would be hysterical with less than half his worries.

The news from Mexico is highly encouraging The Supreme Court of Mexico has enjoined the Department of Commerce and Industry from "denouncing" or sequestering the rights of the Texas Company to oil under the lands owned or leased by it prior to May 1, 1917. The attempt to make the New Mexican constitution retroactive is thus frustrated and one of the things for which Secretary Hughes was contending is secured. It is predicted that early recognition of the Obregon government by the United States will follow though this seems doubtful.

The decision of the court was curiously synchronous with the arrival of the American oil magnates in the city of Mexico, but it is none the less satisfactory because it justifies my prediction that it would be found that there was a community of interest between Obregon and oil.

There can remain no doubt as to the value of oil as a lubricator, and if through its application the gates of Mexico shall again be swung open to American enterprise it may be that the event will provide a psychological stimulus that will hasten the business revival that seems to be impending in the United States.

Exports of Electrical Machinery Increasing

Official announcement from Washington of the creation of a "Division of Electrical Machinery" in the Department of Commerce calls attention, says the *Trade Record* published by the National City Bank of New York, to the growing demand of the outside world for American equipment for harnessing this latest servant of man—electricity. In the opening year of the war, our fiscal year 1915, our entire exports of the group officially designated as "electrical machinery and appliances" amounted to but $19,772,000 but had advanced to $54,547,000 in its closing year 1918. Then with the world's return to peace and its closer acquaintance with the quality of our manufactures in this line, the total exports of "electrical machinery and appliances" jumped to $80,000,000 in 1919, $87,000,000 in 1920, and $119,221,000 in 1921, the fiscal year just ended.

This increase of $32,000,000 in the exports of this class of merchandise in the fiscal year 1921 is the more remarkable in view of the fact that in the other important classes of machinery the exports of 1921 showed but comparatively slight gains. The exports of electrical machinery increased 37 per cent in value in the fiscal year 1921, while those of all other machinery were increasing but 10 per cent in value.

Electric motors are the biggest single item in the $119,000,000 worth of exports of this character in 1921, amounting to over $18,000,000, dynamos and generators about $7,000,000, and insulating wire and cables over $11,000,000. The 1921 figures showed in each instance a larger total than in 1920, despite the fact that prices per unit of quantity in 1921 were in many instances less than in 1920.

Sugar Machinery in Ecuador

The acreage of all Ecuadorian sugar plantations is increasing. More sugar-making machinery is being installed and modern methods of cane manufacture are being inaugurated with the introduction of American agricultural machinery and implements. The high prices for sugar that have prevailed in Ecuador from the beginning of the war to the present time have given the sugar-mill proprietors the opportunity of introducing important improvements in the way of new machinery for their plantations.

Business Conditions as the Big Banks of the Country See Them

The First National Bank of Boston Comments on General Business

A general betterment of feeling and a somewhat more buoyant attitude toward business is in evidence throughout the country. In New England it is specially marked, due to the fact that several of its principal industries have experienced a distinct increase in activity during the past month. Figures bearing on shoe manufacturing are now available, which show two things: first, that the manufacturers have come through the past year with surprisingly few failures; and second, that they have worked out of the severe depression of recent months to a point where production compares well with the similar periods of 1920 and 1919. Their present position is made more comfortable by very cheap materials and an easier labor situation. The increase in production is conspicuous. In the combined woolen and worsted industry, mills have so increased production that it may fairly be said that a normal percentage of machinery is in operation. The openings of the largest interest were successful at fair prices, with full production up to January 1st allotted. The consumption of wool is therefore nearly normal in amount and raw-material merchants have been able to show reasonable profits for the first half of the year. In cotton manufacturing a stronger demand has appeared, influenced by scant stocks and the short cotton crop, the smallest in a quarter of a century. In this industry the improvement has been both in volume and prices. During the last ten days the prices of print cloths have sharply risen and it is hoped that the mills may soon be able to run at some profit. This will be a welcome relief, as they have, in the main, been running on part time at a loss, to preserve their working forces. The above conditions, coupled with an easier money situation, are chiefly responsible for freer movement of goods, and retail trade, seasonally dull, is continuing at a high level both in units and in dollars. Nevertheless, the general trade depression continues, as witness low bank clearings and idle freight cars. While commodity indices are not registering such sharp declines as in earlier months, Bradstreet's actually scoring in advance in June, the great steel industry is experiencing a sinking spell, production being perhaps at 20 per cent of capacity—virtual stagnation. Price cuts have been drastic and wages are being reduced, the attitude of labor being reported as comparatively acquiescent. The deflation of this basic industry and its many related lines is being observed with the greatest interest as a necessary forerunner to generally better business. The crop situation in this country is reasonably satisfactory and has been made easily on account of plentiful labor and lower wages. It has been estimated that the wheat crop was produced at 35 per cent less cost than last year. The convalescent period which must precede healthy business is apparently to be a long-drawn-out one. Reports of very unsatisfactory conditions in countries abroad confirm this.

A new cotton crop year began Aug. 1. The cotton crop conditions as of July 25, as reported by the Government, was 69.2 per cent, the acreage 26,519,000, which is a decrease of 10,524,000 acres, or 28.4 per cent from last year's figure. The report indicates a yield of 8,433,000 bales, as compared with 13,365,754 last year, 11,420,000 two years ago, and 12,040,532 bales three years ago. In 1914 the yield was 16,134,000 bales. The amount of commercial fertilizer used was about 66 per cent of the average annual amount from 1917 to 1920. The world cotton crop of last year is estimated by the Government at 19,395,000 bales. Cotton consumption for this country, while still under the figures of a year ago, has been showing a steady gain, and is now larger than at any previous time this year. The crop condition on July 25th compares with a ten-year average at this date of 78.8 per cent. Household and cotton dress production has been stimulated by the low prices current, and consumption has been more active in relation to other textiles than has been noted for several years.

Business in iron and steel has been improving gradually in recent weeks, and the hope is growing that July will prove to have marked the low point in output and bookings. While sales have not kept pace with inquiries, orders have been more numerous than previously, although still small. Car repair orders have been perhaps the brightest spot in the markets. The demand for steel sheets has improved perceptibly. Mahoning Valley mills recently attained an operating rate of 52 per cent, as against a rate of less than 30 per cent in recent months. A noticeable enlargement in demand has appeared in nails, wire and pipe from jobbers, who have been moving tonnage at 65 to 75 per cent of the normal rate. Some important sales of basic pig iron, amounting to several thousand tons, have been closed in Philadelphia, the first real activity in this fundamental market in months. Works operations have been extremely low. Steel ingot output in July was at the annual rate of 11,870,000 tons, a rate below the output for any calendar year since 1900. Pig iron output touched new low levels since records first were kept, some fifteen years ago. July iron output was 864,580 tons, or about 28 per cent of the output for July a year ago. The number of furnaces in blast Aug. 1 was 69, out of about 400 standing in this country. The wage reduction movement still is under way. The Cambria Steel Co. recently announced its third cut of the year, amounting to 16⅔ per cent and placing common labor on a basis of 25 cents per hour. The H. C. Frick Co. and the Oliver Iron Mining Co. posted a second cut of 10 per cent, returning to the late 1917 rate. These are subsidiaries of the United States Steel Corporation. The iron and steel industry is pressing for a reduction in freight rates and several conferences between shippers and railroad representatives have been held. A reduction of 20 per cent has been discussed. If such reduction should be effected it would reduce the cost of production about $2.50 to $3 per ton. Independent steel mills adopted new open price schedules July 21, $3 a ton below the scale previously announced by the Steel Corporation. Later the leading interest departed from its custom of maintaining a regular price schedule and has freely met competition for all deliveries. In some cases prices have been cut so low as to indicate some demoralization, but the cutting has stimulated buyers' interest.

Europe's Gold Reserves Gain

While Europe sent to the United States more than two hundred and fifty million dollars in gold during the first six months of the current year above receipts from this country, nevertheless a slight gain occurred in that period in the total gold reserves of Europe held by central banks or government agents.

Only three of the fourteen chief European gold holding countries showed a diminution in their gold stocks from Jan. 1 to July 1, and these losses were relatively slight, their combined total amounting to less than twelve million dollars. This loss was more than offset by gains among the other eleven countries, the net increase of the fourteen combined amounting to $1,199,000.

Yet between Jan. 1 and July 1, the gold stock held by the Federal reserve banks in the United States increased by $402,601,000, or nearly 20 per cent of the $2,059,330,000 they held the first of the year, almost two-thirds of the increase being made up by the gold from European shipping points, the rest coming from non-European and domestic sources.

An analysis of this gold movement shows that present European gold reserves are not being drained to swell America's holdings, but that the increments to this country's hoard since the first of the year, in so far as shipments from European points are concerned, are chiefly accounted for by three great streams of the metal consisting of newly mined supplies from Africa coming by way of London; of gold yielded up by India, also coming by way of London; and of metal thought to have originated from Russian sources, eventually coming to America through European countries.

Europe's centralized reserves were built up subsequent to the outbreak of the war far above prewar figures, and were further increased since the armistice, by concentrating in them as far as possible all gold privately held. While these reserves by continued government impoundage, have been kept rigidly stabilized at the points attained as a result of those extraordinary war and postwar measures, in the face of the recent tremendous suction toward America, nevertheless the three great streams have flowed through these countries to the United States with little impediment during the last six months. No material effort has been made in Europe to divert the gold from them for the purpose of building up further the reserves there. The gold has served to reduce European indebtedness in America rather than to aid in restoring the gold standard in Europe.

It was stated in the Federal Reserve Bulletin for June, 1921, that the Director of the Swedish Mint had recently estimated that seventy tons of Russian gold were received in Sweden since 1920. He was quoted as saying that after refining it was reexported, chiefly to the United States, representing an assayed value here of about $40,000,000. The bulletin also said that not less than another $60,000,000 of Russian gold or its equivalent had found its way to the United States through France and other channels.

The movement of gold from Russia to the United States is not definitely traceable. It is thought to have come to this country indirectly through various continental countries in addition to those mentioned above. At the outbreak of the war in 1914 the Russian State Bank held $779,750,000 in gold; by the end of 1917, the date of the last definite statement of gold held in the bank, the stock had dwindled to $633,000,000. It has been reported that this balance has since been largely dispersed and the amount remaining is unknown, but is thought to be small.

It appears therefore that the United States received, between Jan. 1 and July 10, the equivalent of $106,599,000 of African and Indian gold by way of London and the equivalent of more than $100,000,000 of Russian gold by way of Continental Europe. These three chief sources account for the fact that Europe as a whole has been able to make substantial gold payments to the United States.—*National Bank of Commerce.*

The Farmer as a Factor in the Nation's Prosperity

The plea of the labor leaders against a reduction of wages would be sound if wages were being reduced below the level of prices ruling for the products of labor, or below the general compensation of the great body of workers outside of their own organizations.

The trouble at the present time is that what the labor leaders are protesting against has already happened to more than one-half the workers of this country. The former are trying to maintain the pay of a minority, at the expense of the majority.

The farmers and producers of practically all primary products and raw materials have taken reductions of approximately one-half the value of their products. The prices of their products are back to the pre-war level. They have lost a great proportion of the purchasing power they have been using in recent years, and the market for the services of all the workers who have been supplying them has been curtailed accordingly. This is the fundamental cause of the unemployment which has spread over this country in the last year, since cotton, corn, oats, live stock, rice, wool, hides, dairy products, flax seed, the principal metals and other primary products began to fall. It is true that as factory-workers and others were thus forced out of employment the evil effects have been increased but the original impulse and the main influence comes from this great body of people who extract wealth directly from nature and who are largely dependent upon world markets.

Moreover there is no prospect of a recovery of farm products to the levels of war time. Doubtless they are now unduly depressed and will swing back to a normal level with improvement in general conditions, but any expectation that they will recover to the war level, or to the present general level of wages and manufactured goods, is wholly unwarranted. The sooner war-time prices and wages are forgotten the better. They are not normal in times of peace.—*National City Bank of New York.*

The Swiss Machinery Industry

SPECIAL CORRESPONDENCE

The Association of Swiss machinery manufacturers has just published its annual report from which we gather the following information.

The great difference in the exchange of foreign currency as well as the general international stagnation have largely influenced the Swiss machinery market. The protective policy of a number of foreign countries has been another drawback to the extension of the market. The following figures refer to the years 1913 and 1920.

The imports of steam engines amounted in 1913 to 7,632 metric quintals (a metric quintal equals 50 kilograms, approximately 100 pounds) in 1920 to 3,549 metric quintals; the exports in 1913 to 55,946; and in 1920 to 32,941 quintals. In spite of the general demand for electricity quite a number of orders for steam engines could still be booked. Also for water turbines the foreign demand remained satisfactory. Imports amounted in 1913 to about 4,000 quintals and in 1920 to about the same figure, while exports of water turbines decreased from 49,385 quintals in 1913 to 37,372 in 1920. In combustion power machines the imports in 1902 with 3,261 quintals were double as much as in 1903, while the exports increased from 63,000 quintals in 1913 to 76,675 in 1920. Agricultural machines of all kinds were largely imported from Germany. From 39,397 quintals in 1913 the imports rose to 78,300 in 1920, while the exports decreased from 6,500 quintals in 1913 to 3,369 in 1920. The Federal authorities have now prohibited the importation of this class of machines. Flour mill machinery is scarcely imported while the exports amounted to 69,703 quintals in 1913 as against 58,932 in 1920. As far as textile machinery is concerned business was satisfactory in the case of spinning and twine machines; imports decreased from 15,400 in 1913 to 12,608 in 1920; while exports rose from 12,100 in 1913 to 22,884 quintals in 1920. Weaving machines were chiefly exported to the devastated districts of France and Belgium. The imports of machine tools have largely increased, from 38,670 quintals in 1913 to 111,874 quintals in 1920. Exports increased likewise from 9,785 quintals in 1913 to 81,366 quintals in 1920. Considerable quantities of machine tools are imported from Germany, chiefly on account of the low value of the German mark. Woodworking machines have been imported only to a small extent and the exports were also very small. In electric machinery, imports decreased from 7,620 quintals in 1913 to 3,696 quintals in 1920, while the exports decreased from 79,000 quintals in 1913 to 66,574 quintals in 1920. The exports of electrical machines are largely influenced by the additional tariff rates levied by various countries, which, for instance, vary in France according to the material used, from 100 to 300 per cent; in Italy they amount to 100 per cent and in Belgium to the threefold of the regular duties. Automobiles were imported to the amount of 120,671 quintals in 1920 as against 10,594 in 1913. Exports however decreased from 21,714 quintals in 1913 to 18,209 in 1920. The locomotive works are chiefly engaged in repair work for foreign countries. On account of the electrification of the Federal Railways and of many private lines the demand for steam locomotives has largely decreased while considerable orders for electric locomotives have recently been placed.

Smyrna Needs Motor Water Craft

Vice Consul A. Wallace Treat, Smyrna, Asia Minor, in a recent report says that requests have been received at the consulate for information concerning American motor boats and motor launches. Therefore, it is suggested that manufacturers and exporters of these craft forward their catalogs or other material descriptive of their products to the consulate. Such material should preferably be in French and should be accompanied by a price list, but if catalogs and other descriptive materials are not published in French the English edition should be sent.

The harbor of Smyrna is large, landlocked, and offers splendid opportunities for all forms of water transportation, light and otherwise. The actual pleasure-boat season is of about eight months' duration under ordinary conditions.

Sailed for Europe

J. H. Drury, treasurer of the Union Twist Drill Co., Athol, Mass., sailed last Saturday on the steamship "Olympic" for an extended business trip in Europe.

Dietz Leaves Norton Co. For Presidency of Bridgeport Brass Co.

Carl F. Dietz, vice-president and sales manager of the Norton Company, Worcester, Mass., has resigned to become president and general manager of the Bridgeport Brass Co., Bridgeport, Conn. He will finally sever his connection with the Norton company on Oct. 1, when he will assume his new duties at Bridgeport. He succeeds as president Fred J. Kingsbury, of New Haven, who wishes to be relieved of some of his responsibilities and who now becomes chairman of the board of directors. Mr. Dietz will also be general manager of the brass works. He has been connected with the Norton Company for ten years, first as plant manager, then as assistant sales manager and afterwards as sales manager of the wheel division of the business. Two years ago when the Norton

CARL F. DIETZ

Company and the Norton Grinding Company were consolidated, he was made vice-president and sales manager. He was born in New York, Feb. 12, 1880, and was graduated from Stevens Institute of Technology in 1901, and subsequently took post graduate courses in the Royal Technical College, Berlin, in sciences, metallurgy and mining. Early in his career he was employed for three years at plants of the United States Steel Corporation, largely in blast furnace operation and gas engine installations. In 1905 he engaged in the development of zinc-smelting processes, and later operated a mining lease in Utah, installing a dry method for concentrating lead silver ores. He designed and built modern ore-milling plants for the American Glue Co., as a part of its sandpaper factory at East Walpole, Mass.; Grunelli Chemical Co., Park City, Utah, where the separation of iron and zinc sulphides was the problem; and the Ozark Smelting and Mining Co., Magdalena, N. M., where the zinc ore required concentration for paint making. In 1908 he joined the Minerals Separation, Ltd., of London, as consulting engineer and in the interest of this company developed treatment methods at the Dunderland iron ore deposits in Norway, north of the Arctic Circle, and studied ore treatment methods for properties in Russia, Bolivia, Australia and Africa. He also put into operation the San Francisco del Oro mines in Mexico, yielding complex lead and silver ores. He is a member of the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, and is secretary of the National Machine Tool Builders Association.

Vice-president William Le Coste Neilson, foreign sales manager of the Norton Company, with headquarters in London, is now on his way to the United States and will succeed Carl F. Dietz as sales manager of the Norton Company.

New Steel Process in Japan

A new process by which sand iron, or magnetic sand, may be converted into pig iron and thence into steel, has just been made public by Goro Matsukata and Dr. Asobu Naito of Japan. They claim this will not only revolutionize the steel industry in Japan, but of the world. The process combines sand iron with coke, using hot gas flames and making ferro-coke, from which iron can easily be taken.

The discoverers claim that the new process will make Japan independent of England or the United States in the matter of iron imports.

Car Loadings Increase—Still Behind 1920

An increase of 7,471 in the number of cars loaded with revenue freight during the week which ended on Aug. 30, compared with the previous week, was shown by reports just received by the car service division of the American Railway Association from the railroads of the United States. The total for the week was 816,436 cars. This was a decrease, however, of 151,667 cars compared with the total for the corresponding week last year, and 96,773 cars under that for the corresponding week in 1919.

The principal increase, compared with the week before, was in the loading of merchandise and miscellaneous freight which includes manufactured products, although there was a substantial increase in shipments of live stock. Loadings of both coal and grain and grain products, however, were under the previous week.

The total number of cars loaded with merchandise and miscellaneous freight was 491,922 which was 12,173 more than during the week of Aug. 13. It was, however, 43,000 less than were loaded during the corresponding week one year ago.

Loading of live stock amounted to 29,110 cars or an increase of 2,275 cars over the preceding week and 2,000 cars over the total for the corresponding week in 1920. There was also an increase of 150 cars over the week before in the loading of coke, the total being 4,436.

Coal loadings, which during the week of Aug. 13 went up to 158,260, dropped back to 154,140 or a decrease of 4,120. This was 50,000 under the corresponding week last year. Grain and grain products totaled for the week 59,875 cars or 1,685 under the week before but 18,237 cars in excess of the same week in 1920 and 7,900 more than were loaded during the corresponding week in 1919.

Loading of forest products totaled 44,583 cars or a decrease of 750 cars compared with the previous week while ore decreased 572 cars from the week before to a total of 32,370.

Compared by districts, slight decreases under the week before were reported in the Allegheny, Pocahontas and Southern regions while all the others reported increases. All, however, were under the totals for the corresponding week in 1920.

Annual Outing of Machinery Club of Chicago

Notice has just been received of the sixth annual outing of the Machinery Club of Chicago, to be held on Saturday, Sept. 10, at Thatchers Woods, River Forest, Chicago.

A lengthy program of entertainment has been arranged which will be varied with athletic games and special attractions for the children. The feature of the day, which has been the big event on other occassions, will be the fried chicken lunch. Each person attending the picnic will receive a lunch box containing a portion of the delectable fowl together with all the usual fixin's. A seven-inning ball game, tug-o-war and other contests between rival companies will also take place.

It is expected that all the machinery and supply houses in the city will close at noon on that day. In case of rain the festivities will be held in the rooms of the Machinery Club.

National Congress of Engineers at Buenos Aires

The second National Congress of Engineers of Argentina will be held in Buenos Aires from Sept. 23 to Oct. 9, under the auspices of the "Centro Nacional de Ingnieros" to commemorate the centennial of the founding of the University of Buenos Aires. The papers presented will cover in a complete manner such subjects as Argentine petroleum, road construction, irrigation, mining, navigation, and labor problems. A list of the subjects, as transmitted by Commercial Attaché Edward F. Feely, is available at the Latin American Division, Bureau of Foreign and Domestic Commerce.

X-ite, a Heat-Resisting Alloy

The General Alloy Co. of New York and Chicago, announces a low-priced heat-resisting alloy to be known as X-ite. It is claimed that this alloy has about four times the life of steel and that containers made from it retain their shape at high temperature. The company states that X-ite is a development from eleven years of research and experiment and that over thirty tons of experimental castings were made and tested before the material was marketed.

Washington Notes

By Paul Wooton

Washington Correspondent

Further legislation probably will be required before the War Department will settle the Bethlehem wage claim which involves nearly $1,500,000. This amount is claimed by employees of the Bethlehem Steel Co. under an award made by the former National War Labor Board. Of the amount claimed $900,000 is apportioned to machine shop workers.

The award was made July 31, 1918. It was a result of a demand made by the employees of the Bethlehem Steel Co. at a critical period during the war for an increase in wages. The company did not put the award into complete effect except in the case of the electricians, because of its inability to secure from the Government an agreement to reimburse the company for the difference in the labor cost on Government contracts.

The War Department admits that the Government is under some moral obligations to make this payment. It is pointed out, however, that it is not entirely a War Department matter as the Bethlehem company was engaged at the same time on contracts for the Navy Department and for the Shipping Board. Since the War Department does not feel that it has the legal authority to make this payment, it is believed that the entire matter will be turned over to Congress, although the International Association of Machinists has made an application to the Secretary of War for a rehearing. It is the contention of the machinists' association that the War Department has the power to make the payment and it objects to the delay which necessarily must ensue if payment must await the passage of additional legislation.

Test Motor Carriages

A number of motor carriages for 155-mm. guns are being subjected to gruelling tests at Camp Jackson, South Carolina. The carriages are being made to cross trench systems, wire entanglements, shell holes and such conditions of terrain as might be met in a battle area. The carriages being tested were designed and built by Walter Christie of the Front Drive Motor Co. While the tests have not been completed it has been demonstrated that they are able to maneuver successfully over very difficult ground. The carriage is a combined wheel and track-laying vehicle which can be operated on its rubber tired wheels at a maximum speed of 15 miles an hour when good roads are available. When it is necessary to use the tracks, they are disposed over the same wheels.

Would Reduce Noise

If tanks are to be used in warfare with the maximum of success, means must be found for reducing the noise so characteristic of the tank used in the late war. So as to enable tanks to make use of the element of surprise, the Ordnance Department of the Army is making extensive studies looking to its elimination. Most of the noise has its origin in the caterpillar tracks. The steel track rollers also produce noise. In the experiments looking to the reduction of noise, rubber cord track rollers are being employed. Rubber and fabric are being used on the track-driving sprocket and on the Idler sprocket, where the track shoes come into contact with those surfaces. Rubber pads are being applied to the wearing surfaces of the track shoes themselves.

Proposed Subway and Tunnel for Havana, Cuba

Plans for the subway system and tunnel proposed for the city of Havana have been exhibited to a representative of the American consulate general at Havana, Cuba. Consul General Carlton Bailey Hurst's representative was shown documents indicating that the necessary concessions for the work had been approved by the Cuban Railroad Commission, and that the Cuba North & South Railroad Co., organized to promote this project, had been completed in accordance with Cuban laws governing the organization of companies for railroad construction. A representative of the firm of engineers in charge (Sr. Serafin Sanchez Govin, No. 62 Villegas Street, Habana), holding a full power of attorney to act for the Cuba North & South Railroad Co., declared his intention of going to New York in October or November to arrange for the necessary capital and expressed a desire to receive correspondence from persons in the United States who may be interested in either the structural or the investment possibilities of the project.

Proposed Officers for Purchasing Agents

The nominating committee of the National Association of Purchasing Agents has submitted the following names for the election which will be held at Indianapolis, Ind., in conjunction with the annual meeting of the organization, Oct. 10 to 13. For president, W. L. Chandler, Dodge Sales and Engineering Co.; first vice-president, A. H. Reinhardt; second vice-president, T. P. Webster; third vice-president, A. V. Howland; fourth vice-president, S. F. Woodbury; fifth vice-president, D. E. Ferguson; treasurer, W. J. Gamble; secretary, L. F. Boffey.

Business Items

The engineering department of the Willys-Overland plant at Elyria, Ohio, will be transferred to Toledo, on Nov. 1. The shift in the engineering department will make no change in the production plan at the Elyria plant. Under the new plan the Elyria factory will be managed directly from the Toledo headquarters.

A $250,000 fire practically destroyed the plant of the Vulcan Iron Works, Jersey City, N. J., on Aug. 22.

The Metals Casting Co. of America, manufacturer and distributor of the Schoop metal spraying process, is now in full operation at its new plant in Philadelphia, Pa.

The O'Neil Engineering Co., incorporated for $5,000, will operate a plant in Toledo, Ohio, for the manufacture of special machinery. Frank O'Neil and Frank R. Smith are the incorporators.

The Raybestos Company, of Bridgeport, Conn., with factories in Bridgeport and Stratford, Conn., recently increased the capital stock of the company from $3,000,000 to $8,000,000, to be used for the purchase of the General Raybestos and Rubber Co., of Charleston, S. C., plants, at Charleston, S. C.

Sales records of passenger automobiles during second quarter of 1921, are reported as 177,885 cars exclusive of sales of Ford plants. It is estimated that sales represent a 57 per cent of capacity production for factories covered.

Production of pig iron during the first six months of 1921 showed a reduction of nearly 50 per cent in comparison with production for the same period of 1920; of basic pig iron production was 4,504,431 tons in 1921 six months period as compared with 8,287,028 tons in corresponding period of 1920.

The Woodward Wrench Co., of Springfield, Mass., has recently been incorporated under the laws of Massachusetts to manufacture wrenches, tools, etc. The capital stock of the new company is $500,000, divided into five thousand shares of $100 each. William S. Thompson, Springfield, is the president; Benjamin W. Woodward is vice-president, and Charles M. Comins, of Longmeadow, Mass., treasurer.

The Efficiency Engineering Corporation has been organized at Orlando, Fla., to manufacture and sell driving mechanisms, etc. Officers are N. O. Overstreet, president; Benjamin Drew, vice-president; P. L. Billingsley, secretary.

H. L. Seaman Supply Co., Jacksonville, Fla., has been incorporated with $20,000 capital stock. Steel, iron and machinery will be a part of the business. Officers are H. L. Seaman, president; E. L. Seaman, vice-president; J. H. Lawrence, secretary; H. L. Seaman, treasurer.

The Olson Machine Works, Portland, Ore., has been organized to do engineering and designing of machinery and machine plants. J. A. Olson is general manager.

The Automatic Radiator Corporation of Chicago has started operations in temporary quarters in Toluca, pending the erection of a factory of its own. P. A. Sperry is president of the corporation.

The Biblex Products Co. has been incorporated under the laws of the State of Delaware with a capital stock of $500,000. Automobile bumpers will be manufactured. Directors are F. B. Block, H. H. Phillips and C. J. Horn.

The Pitt Tractor Co., Wilmington, Del., has been incorporated to manufacture steel tractors. M. M. Lucey, M. P. Lynch and L. S. Dorsey are the directors.

The Betts Machine Co., Inc., Rochester, N. Y., has opened a district sales office at 1915 Oliver Bldg., Pittsburgh, Pa.

The Penn Machine Co., Johnston, Pa., has been organized and incorporated with $100,000 capital stock. The officers of the new company are: President, John Gibson; vice-president, Thomas Houlton; secretary, George W. Smith. Additional directors are Thurston Wright and Frank Baldwin.

The Ringless Piston Replacement Corporation has been incorporated at Dover, Del.; capital stock $3,000,000. Directors are T. L. Croteau, M. A. Bruce and S. E. Dill.

Faurot-Scope Corporation, Wilmington, Del., has been incorporated to manufacture a device to prevent the theft of automobiles. Capital stock is $1,000,000. Incorporators are N. L. Rogers, L. A. Irwin and W. G. Singer.

For the purpose of manufacturing refrigerating machinery, the Artic Corporation has been formed at Michigan City, Mich., with a capital stock of $200,000. S. W. Wilhelm, E. E. Mikesell and R. L. Henry organized the company.

The Whipp Machine Tool Co., Sidney, Ohio, has redesigned and is developing the open-side combination shaper and planer which it purchased some months ago from the Lynd-Farquhar Co., of Boston, Mass.

The Stoughton Nipple Manufacturing Co. has been incorporated at Stoughton, Mass. Directors are F. C. Philips, C. L. Pratt and J. D. Sillen.

Robert J. Metzler, Inc., Newark, N. J., has been incorporated with $100,000 capital, to deal in machinery. R. J. Metzler, S. Kaufman and A. MacMillan, all of New Jersey, are the incorporators.

The Frostholm-Treiber Company, Rochester, N. Y., has been incorporated with a capital of $24,000 by C. C. and J. H. Frostholm and W. C. Treiber to manufacture tools, piston rings and kindred products. It is represented by Melvin & Melvin, First Trust & Deposit Bldg., Syracuse, N. Y.

Henry Owens & Co., Inc., Providence, R. I., has been incorporated to deal in tools, etc. The incorporators are Henry Owens, Ernest Owens and Charles H. Fallows.

The Prest Machine Works Co., Oklahoma City, Okla., has increased its capital stock from $6,000 to $40,000 with $34,000 paid up. John B. Prest is president.

The Auto Collapsible Rim Manufacturing Co., has been organized at Hart, Mich., and capitalized at $100,000. The capital has been subscribed and paid up and a plant will be secured where from fifty to 100 persons will be employed, it is said.

The Loop Lock Corporation, New York, N. Y., has been incorporated with $50,000 capital stock by L. Herold, T. Resnik and M. Schenkman, to manufacture locks, etc.

Bear Tractors, Inc., New York, N. Y., motors and engines, has been incorporated with $500,000 capital stock, by W. J. Greacen, P. Sawyer and E. Conway.

The Welded Products Co., Birmingham, Ala., is reported planning to increase its capital stock from $50,000 to $100,000.

Personals

James A. Brakes, Jr., has resigned his position as head of the department of mechanical engineering at Ohio Northern University, Ada, Ohio, and is now structural engineer for the Chateaugay Ore & Iron Co., Lyon Mountain, N. Y.

O. L. McIntyre has been placed in charge of the Chicago office of the Fuller Lehigh and Fuller Engineering Co.

Philip S. Van Wyck has resigned from the Chicago Great Western Railroad and is now with the Mesabi Iron Company Babbitt, Minn.

W. C. Brumble, formerly resident mechanical engineer, Muncie Products Division, General Motors Corporation, is now equipment engineer for Durant Motors, Inc., Long Island City, N. Y.

M. C. Gillett has been transferred from manager of the Philadelphia branch office to plant manager of the Standard Heater Co., at Williamsport, Pa.

Graham L. Montgomery has recently organized the firm of Montgomery & Fishkind, consulting engineers, New York, which will handle consulting work of a mechanical and structural nature. He has also become a partner in the firm of Vreeland, Fishkind & Co., industrial engineers and architects, of New York.

J. E. Woods has recently joined the general sales division of the Pacific coast organization of the Gilbert & Barker Manufacturing Co., of West Springfield, Mass. Mr. Woods will work out from San Francisco.

George W. Hocking, secretary of the Wheeling Steel Corporation, Wheeling, W. Va., since its organization a year ago, has tendered his resignation to the board of directors. Mr. Hocking has been connected with the Whitaker-Glessner Co., a subsidiary of the Wheeling Steel Corporation, for upwards of 20 years, serving with that company as secretary until the organization of the Wheeling Steel Corporation.

Frank Welsh, who at one time was connected with the sales department of the Republic Iron and Steel Co., Youngstown, Ohio, has returned to that company, succeeding W. W. Hall as assistant manager of sales in the Pittsburgh district. Mr. Hall succeeds Charles S. McKinley as assistant manager of sales at Youngstown. Mr. Welsh resigned from the Republic company Dec. 1, 1917, and after engaging in the export business in New York, became manager of the New York office of Hickman, Williams & Co. For several months past he has represented the Detroit Graphite Co. in Pittsburgh.

Secretary Hoover and Assistant Secretary of Commerce Huston have recommended to President Harding the appointment of D. B. Carson, of Tennessee, as Commissioner of Navigation, succeeding Eugene Chamberlain, who had served 28 years in that office and will be made an expert on the staff of the Bureau of Foreign and Domestic Commerce. Mr. Carson has been for 30 years general manager of the Nashville, Chattanooga & St. Louis Railroad.

Harwell C. Booth has been appointed district manager of sales in the New York office of the Columbia Steel and Shafting Co., Pittsburgh, Pa. Mr. Booth succeeds Edward T. Corbus, who has assumed more important duties in another field.

Victor M. Johnson has resigned as secretary and manager of the Free Sewing Machine Co., Rockford, Ill. To fill his place Frank J. Kelley was elected secretary and A. E. Johnson manager.

J. H. Edwards, manager of the Elyria (Ohio) plant of the Willys-Overland Co., has resigned.

J. P. Oliveau has been appointed chief engineer of the Mercer Motors Co., Trenton, N. J. Mr. Oliveau is a French engineer and was formerly connected with the Panhard, Delahaye and Peugeot cars.

H. L. Gardner, general sales representative at Bakersfield, Cal., for the Gilbert & Barker Manufacturing Co., Springfield, Mass., sailed recently for Rotterdam, Holland, with his family. Mr. Gardner has been granted a leave of absence by the company.

Elmer H. Havens, president of the Hunter & Havens Co., steel merchants, of Bridgeport, Conn., has been chosen president of the Locomobile Company of America, Bridgeport, Conn., maker of Locomobile automobiles and Riker trucks.

D. J. Mahoney, of the general sales department of the Gilbert & Barker Manufacturing Co., Springfield, Mass., has recently been transferred to Butte, Mont., where he will represent the interests of the company with the Continental Oil Co.

B. G. Dann, for the past four years with the engineering department of the Tuscon Steel Co., Youngstown, Ohio, has resigned to become manager of the New York office of the Hendrick Manufacturing Co., Carbondale, Pa., manufacturer of perforated metal and general sheet and light structural iron work.

Guy P. Miller, treasurer and general manager of the Bridgeport Brass Co., Bridgeport, Conn., has severed his connections with that company. Mr. Miller has been with the Bridgeport Brass Company for the past twenty-one years.

Frederick J. Kingsbury, president of the Bridgeport Brass Co., Bridgeport, Conn., has resigned his position as president of the company, and will assume the combined duties of chairman of the board of directors and treasurer from now on.

Trade Catalogs

Thermalloy. The Electric Alloys Co., 1692 Glenmount Rd., Cleveland, Ohio. A six-page bulletin describing the properties, production and uses of a high chromium alloy know as "Thermalloy." A table showing the physical properties of the metal is given, also two line drawings showing rate of oxidation and comparative heating efficiency of thermalloy, steel and cast iron.

Rego Welding and Cutting Apparatus. The Bastian-Blessing Co., 125 West Austin Ave., Chicago, Ill. Catalog No. 23 describing and illustrating "Rego" welding and cutting torches, soldering torches, regulators, complete welding and cutting outfits, and the fittings for use with this equipment.

Die Heads. Geometric Tool Co., New Haven, Conn., Catalog describing a line of self-opening and adjustable die heads, chaser grinders, threading machines, chucks and collets.

Twist Drills. Rockford Twist Drill Co., Rockford, Ill. Catalog No. 10, giving full descriptions, with illustrations, of a line of high-speed and carbon twist drills. Specifications and price lists are included for each type.

Universal Piston Vise. The Manley Manufacturing Co., York, Pa. Catalog No. 350 describing the Manley universal piston vise for use in garages and repair shops.

Nazel Air Hammer. Nazel Engineering and Machine Works, Philadelphia, Pa. A 24-page catalog illustrating and describing power hammers. It is a very complete catalog on this type of machine.

Standard Punch and Die Sets. Diamont Tool & Mfg. Co., Inc., 91-97 Runyon St., Newark, N. J. A 4-page pamphlet setting forth the advantages of using standard punch and die sets as produced in quantity by this firm. Diagrams are included showing the dimensions of the punch and die sets.

Greenfield Taps and Dies. The GTD Corporation, Greenfield, Mass., is now distributing a new catalog describing the small tools and pipe tools which comprise the greater part of its product. There are about seventy pages of tables and other information at the back of the book of interest to the user and designer of tools and machinery. The tools described include screw plates, taps, dies, drills, reamers, milling cutters, bits, arbors, countersinks, hobs, tap and drill kits, mandrels, sleeves, sockets, stocks, tap wrenches, pipe vises and pipe wrenches.

Pamphlets Received

Selection of Fuels: W. S. Rockwell Co., furnace engineers and contractors, New York City, N. Y. One of a series of papers relating to the selection and use of fuels and equipment for industrial heating operations. Several charts are provided which show the comparative costs and rates of efficiency of various heating elements.

Real Production Tools: Goddard & Goddard Co., Detroit, Mich. A four page pamphlet, number one of a series, largely educational, in the interest of better production. This number deals with the half side mill.

Training for Foreign Exploration: School of Mines and Metallurgy, University of Missouri, Rolla, Mo. A reprint of the annual commencement address of H. Foster Bain, dealing with the qualifications of the mining engineer, especially for research work.

The Coal Problem: Senator James A. Reed, of Missouri. The full text of Senator Reed's speech, delivered before the Senate on June 28, when that body had under consideration Bill 1806, "A bill to further amend the interstate commerce act, as amended, to provide for seasonal rates for the transportation of coal," and Bill 1807, "A bill to aid in stabilizing the coal industry." Printed in the government printing office, Washington, D. C. Copies may be had on request.

Crop and Business Conditions for 1921: Continental and Commercial National Bank of Chicago. A forty-page pamphlet giving some valuable facts concerning the distribution of crops over the United States. Maps and charts showing annual production and prices of the principal crops are included.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A manufacturing company in Ireland desires to purchase cigarette-making machines for use in factory. Quotations should be given f. o. b. New York or c. i. f. Irish port. Terms: Cash against documents on delivery. Reference, No. 3537.

A merchant in Norway desires to purchase and secure an agency for the sale of iron, steel, and metals. Quotations should be given c. i. f. Norwegian port. Payment to be made through banks in Norway and in New York. Reference, No. 35378.

A mercantile firm in Spain, having facilities for the marketing of merchandise all over Spain, desires to be placed in touch with manufacturers of motors, electrical machinery, telephones, ventilators, counting machines, adding machines, all kinds of lighting fixtures, accessories and installations, scales, and other weighing devices, turbines, dynamos, insulated materials, covered cables, drills, wire, etc. It is the desire of this house to secure exclusive representation of these products. Reference, No. 35385.

A commercial agent in South Africa desires to secure an agency for the sale of wire, bolts and nuts, hardware, etc. Quotations should be given c. i. f. South African ports. Reference, No. 35386.

A commercial agent in South Africa desires to secure the representation of firms for the sale of machinery, including mining, coal-mining, and general industrial equipment. Reference, No. 35372.

A firm of engineers in Colombia desires to be placed in correspondence with manufacturers of machinery for making cellulose and paper, and machinery for making chemicals, such as caustic soda, as well as cyanide of natrium. Reference, No. 35369.

An engineer in Scotland desires to have manufactured by an American firm a ship heating and ventilating plant. The inquirer holds United States patents. Reference, No. 35370.

Forthcoming Meetings

The second International Cost Conference will be held at Cleveland, Ohio, on Sept. 14, 15 and 16, under the auspices of the National Association of Cost Accountants.

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

The twelfth annual convention of the American Manufacturers Export Association will be held in the Waldorf-Astoria Hotel, New York City, on October 5 and 6. A. W. Willmann is secretary.

The fifth annual convention of the Society of Industrial Engineers will be held at Springfield, Mass., Oct. 5, 6 and 7.

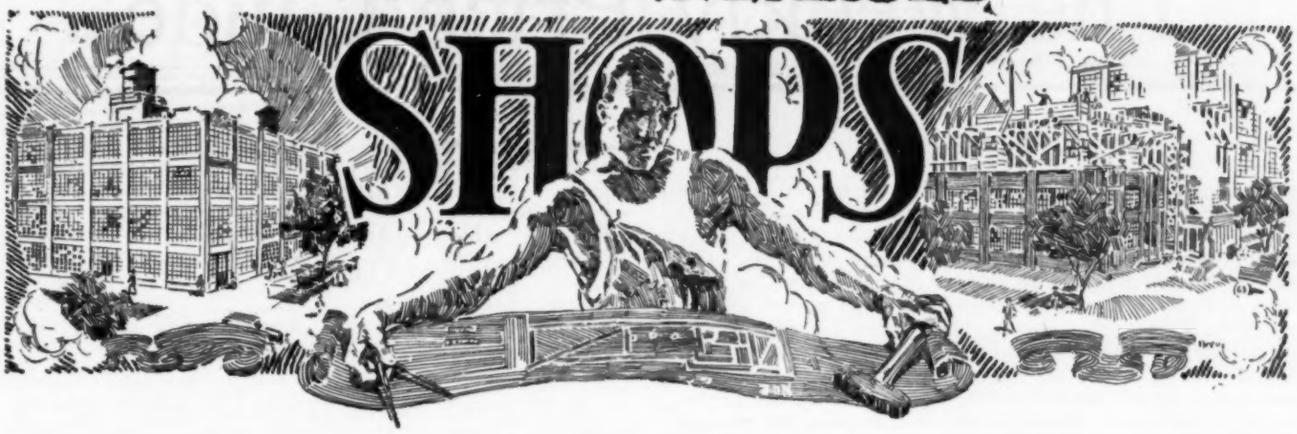
A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The annual meeting of the National Association of Purchasing Agents will meet in the Claypool Hotel, Indianapolis, Ind., on Oct. 10 to 13, inclusive. L. F. Boffey, 19 Park Place, New York City, is secretary.

The American Gear Manufacturers Association will hold its semi-annual meeting at Rochester, N. Y., October 13, 14 and 15. F. D. Hamlin, 4401 Germantown Ave., Philadelphia, Pa. is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

NEW and ENLARGED SHOPS



Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. J., Jersey City—The National Carbon Co., Inc., 580 Henderson St.—one No. 3 Arbor press without stand.

N. J., Jersey City—The Vulcar Iron Wks.—motor driven shear for cutting off round iron up to 1¼ in. diameter and arranged for 440 volt, 2 phase, a.c., or 110 volt, 1 phase a.c.

N. Y., Buffalo—The Hugh Co., Sheet Metal Wks., 163 Adams St., J. M. Brendel, Purch. Agt.—Burr beading machine and small turner.

N. Y., Long Island City—Harold Motor Car Co., Jackson Ave. — small bench grinder, electrically driven with 8 in. wheels.

N. Y., New York—J. F. Oberle, 238 East 42d St., plumbing supplies—power press, grinder with wheelguards and combined punch and shear, all complete, also a bench drill and a high speed power hack saw.

N. Y., New York—The Pennsylvania Co., Co., 50 Church St.—one 48 in. motor driven vertual single head metal boring and turning mill complete with all equipment.

Pa., Phila.—City—C. E. Davis, City Hall, engr.; general machine tools and electric crane for Shawmut pump station.

Va., Ashland—Oliver & Rawlings, G. Rawlings, Purch. Agt.—auto agency and repair shop—complete mechanical equipment.

La., New Orleans—The Auto Service & Sales Co., 936-40 Howard St., L. G. Knight, V. Pres.—repair shop equipment, including drill press, electric motor (4 hp.), crane equipment for wrecker, new and used automobile repairing equipment.

La., New Orleans — The New Orleans Auto Supply Co., Inc., Drydes St., R. E. Zerlin, Pres.—auto repair equipment.

La., New Orleans—The Schayer & Sons, Inc., 1039 Dryades St. and 514-536 Julia St.—small sander for sanding panels; also a machine or tool that can bore and mortise, for general wagon work (new or used).

Mich., Detroit — F. J. Lamb Co., 1938 Franklin St.—one No. 4 or No. 5 Michigan (or similiar make) power punch press with knockout.

O., Cincinnati—The Economy Mch. Co., 428 East Pearl St., J. H. Flynn, Purch. Agt.—one 18 in. Bliss press, one geared punch s, end 12 in. with throat 1¼ in. and 1 in. throw, one bench lathe with 11 in. swing, one 24 in. oil burning furnace with blower attached, and bolt cutter releasing dies ¼ to ½ in.

Kan., Lawrence—The Bd. Educ., c/o I. C. Stevenson—manual training equipment for proposed high school.

Minn., Minneapolis — H. Cleveland, 205 South 7th St.—bench lathes, grinder, buffer, drill press, furnace for case-hardening, etc., 1½ hp. electric motor, 220 d.c.

Ont., Manitowaning — Hinds Garage—complete equipment for auto repair shop.

N. Y., Buffalo—The Buffalo Mill Supply Co., 210 Main St., G. Y. Braun, Purch. Agt.—conveying machinery for unloading salt from box car to crusher.

D. C., Washington—Dept. of the Interior—dairy equipment for St. Elizabeths Hospital.

La., New Orleans—The Washington Ice Co., P. J. Wingerter, Ch. Engr., 611 Louisiana Ave.—internal combustion engines, modern draw water ice plant machinery, etc., for proposed plant.

Wis., Racine — The Harvey Spring & Forge Co.—machinery for the manufacture of springs, etc.

Wis., Sauk City—The Sauk City Canning Co.—canning and conveying machinery.

Wis., Sheboygan—The Lake Mills Condensed Milk Co.—C. A. Bauman, Pres.—canning and milk machinery.

Wis., Tomahawk—The Tomahawk Steel & Iron Co., W. Drever, Pres.—crane.

Cal., Los Angeles—The Western Chemicals Co., 503 Merchants Bk. Bldg.—screening machines, crushers and dryers, for proposed factory.

Ont., Windsor—The Essex Provision Co., Ltd., 1120 McDougal St.—cold storage equipment for proposed plant.

Metal Working Shops

NEW ENGLAND STATES

Pa., Philadelphia—S. W. Evans Co., 4623 Paul St., has awarded the contract for the construction of additions to present factory, on Paul St., for the manufacture of umbrella frames, etc. Estimated cost, $125,000.

Pa., Pittsburgh—The Cunningham Sales Co. is receiving bids for the construction of a 2 story, 85 x 100 ft. garage and sales, on Aspen and Liberty Aves. Estimated cost, $100,000. F. C. Fisher & Co., 419 Oliver Ave., Archt.

MIDDLE WEST STATES

Ill., Chicago—The Yellow Cab Co., 57 East 21st St., has awarded the contract for the construction of a 1 story, 140 x 250 ft. garage, on Flournoy and Lavergne Aves. Estimated cost, $85,000. Noted Aug. 18.

Ia., Rock Island—J. Ryan Fdry. Co., 506 41st St., plans to build a 2 story factory. Estimated cost, $50,000. Architect not selected.

Mich., Detroit—Dept. Motor Transportation, c/o W. Helmboldt, Supt., City Hall, plans to build a 3 story, about 200 x 350 ft garage and office building, on Russell and Alfred Sts. Estimated cost, $400,000. Architect and engineer not selected.

O., Columbus—The Columbus Forge & Iron Co., West 1st Ave., will soon award the contract for the construction of a 1 story, 70 x 200 ft., and a 1 story, 110 x 123 ft. factory buildings. Estimated cost, $80,000. Noted Aug. 11.

Wis., Racine — The Harvey Spring & Forge Co. plans to build a 3 story, 60 x 120 ft. factory, on Main St., to replace the one which was destroyed by fire. Estimated cost, $45,000. Probably private plans.

Wis., Tomahawk—The Tomahawk Steel & Iron Co. will build a 1 story, 100 x 180 ft. plant, for the manufacture of structural steel. W. Drever, Pres. L. A. DeGuere, Wisconsin Rapids, Enrgr.

WEST OF THE MISSISSIPPI

Ia., Des Moines — G. L. Garton, Secy. School Bd.

Kan., Parsons—The Missouri, Kansas & Texas Ry. Co., c/o H. H. Johntz, Railway Exchange Bldg., will receive bids until Sept. 15 for the construction of a 2 story, 50 x 150 ft. machine shop. Estimated cost, $50,000. A. L. Sparks, care of owner, Archt.

Minn., Minneapolis—G. C. Ryan, 523 3d Ave. N., plans to build a 2 story, 85 x 135 ft. garage and sales, on Lake St. Estimated cost, $65,000. Architect not selected.

WEST OF THE MISSISSIPPI

Mo., Clarence—A. Burnett, c/o Clarence Auto Co., is having plans prepared for the construction of a 1 story, 100 x 140 ft. auto repair shop. Estimated cost, $45,000. Burgher Bros., Hannibal, Archt. Noted Aug. 4.

Mo., St. Louis—The Plymouth Garage Co., 5909 Plymouth St., plans to build a 1 story garage, on Plymouth and Hamilton Sts. Estimated cost, $50,000. Architect not selected.

Mo., St. Louis—The Standard Stamping Co., c/o G. Wiegand, 2000 North Broadway, has awarded the contract for the construction of a 1 story, 107 x 132 ft. enameling plant, on Bway. and Madison St. Estimated cost, $50,000. Noted Aug. 25.

CANADA

Ont., Manitowaning—Hinds Garage plans to build a new garage and auto repair shop to replace the one which was destroyed by fire. Estimated cost, $50,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford—The Fuller Brush Co., Inc., 74 Union Place, is having plans prepared for the construction of a 4 story factory, on Windsor Ave., for the manufacture of brushes. Estimated cost, $250,000. Buck & Sheldon, Inc., 60 Prospect St., Archts. and Engrs.

Mass., Shirley — The State Industrial School has awarded the contract for the construction of a 1 and 2 story, 35 x 140 ft. kitchen and laundry building. Estimated cost, $65,000. Noted Aug. 4.

N. H., Concord—The Rumford Press Co., Railroad St., has awarded the contract for the construction of a 4 story, 81 x 180 ft. factory, on Ferry St. Estimated cost, $175,000.

The Weekly Price Guide

This Week's Market

The recent reduction in Pittsburgh mill quotations, have been reflected in the present warehouse prices on steel sheets. No. 10 blue annealed are now quoted at $3.28 as against $3.53, No. 28 black at $4, a reduction from $4.25 and No. 28 galvanized at $5 per 100 lb., warehouse, as compared with $5.25 formerly. Bars have been quoted as low as $1.60, Pittsburgh; shapes and plates at $1.70@1.75. Mill shipments of shapes and plates sell for $2.13@2.23, with bars at $2.08 per 100 lb. New York warehouse prices on shapes and plates remain unchanged. A reduction of ¼c. per lb. in bar iron is quoted at the mill, making the present price 2¼c. as compared with 2½c. per lb. previously.

The only advance in the New York metal market is in the price of tin, which is quoted at 26¾c. as against 26c. per lb. Lead, copper sheets and brass tubing have all dropped ¼c.; while a decrease of ½c. per lb. is reported in brass sheets and rods.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	*$24.50
Northern Basic	†21.52
Southern Ohio No. 2	†22.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	*20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	†21.76
Virginia No. 2	†28.74
Basic	†20.26
Grey Forge	†22.26
CHICAGO	
No. 2 Foundry local	*20.00
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.96
Basic	19.96
Bessemer	21.96

*F. o. b. furnace. † Delivered.

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.75	3.28	3.25	3.53
No. 12	2.80	3.33	3.30	3.58
No. 14	2.85	3.38	3.35	3.63
No. 16	2.95	3.48	3.45	3.73
Black				
Nos. 17 and 21	3.40	3.80	3.80	4.45
Nos. 22 and 24	3.50	3.85	3.85	4.50
Nos. 25 and 26	3.55	3.90	3.90	4.55
No. 28	3.65	4.00	4.00	4.65
Galvanized				
Nos. 10 and 11	3.75	4.00	4.00	4.95
Nos. 12 and 14	3.85	4.10	4.10	5.05
Nos. 17 and 21	4.15	4.40	4.40	5.35
Nos. 22 and 24	4.30	4.55	4.55	5.50
No. 26	4.45	4.70	4.70	5.55
No. 28	4.75	5.00	5.00	5.65

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

BUTT WELD

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	64½	52	⅜ to 1½	39½	24½

LAP WELD

2	56½	44	2	34½	20½
2½ to 6	60½	48	2½ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	62½	51	1 to 1½	39½	25½
2 to 3	63½	52			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
¾ to 3 in. steel butt welded	60%	46%	52½%	43½%	62½%	50%
2½ to 6 in. steel lap welded	51%	37%	55½%	40½%	48½%	46%

Malleable fittings. Classes B and C, Banded, from New York stock sell at plus 6%. Cast iron, standard sizes, 15% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (heavy)	5.00	6.50	8.25
Spring steel (light)	6.00@8.00	6.50	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	2.74	5.23
Cold finished shafting or screw	4.23	3.85	3.85
Cold finished flats, squares	4.73	4.35	4.35
Structural shapes (base)	2.88	2.74	2.88
Soft steel bars (base)	2.78	2.64	2.70
Soft steel bar shapes (base)	2.78	2.64	2.70
Soft steel bands (base)	3.43	.....	.....
Tank plates (base)	2.88	2.92½	2.88
Bar iron (mill 2.25)	2.78	3.52	2.78
Drill rod (from list)	55@60%	55%	50%
Electric welding wire	New York		⅜, 8½c. per lb.

¼—7.15c.; $\frac{5}{32}$ to ¼—6.75c. Swedish iron sells at 18½c. per lb. in Chicago

METALS

Current Prices in Cents Per Pound

	New York	Cleveland	Chicago
Copper, electrolytic (up to carlots), New York			12¾@13
Tin, 5-ton lots, New York			26.75
Lead (up to carlots), St. Louis, 4.35; New York			4.50
Zinc (up to carlots), St. Louis, 4.60; New York			5.00
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.00	25@26	30
Antimony (Chinese), ton spot	5.25	6.00	6.00
Copper sheets, base	19.75	20.75@21	20.00
Copper wire (carlots)	15.50	15.50	14.00
Copper bars (ton lots)	18.50	22.00	18.50
Copper tubing (100-lb. lots)	19.50	23.00	20.00
Brass sheets (100-lb. lots)	15.25	18.00	15.75
Brass tubing (100-lb. lots)	18.25	20.00	18.50
Brass rods (1,000-lb. lots)	13.25	15.50	13.75
Zinc sheets (casks), (8% dis. carlots)	11.00	11.15	15.75
Nickel (ingot and shot), Bayonne, N. J.	41.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	44.00	.....	.....
Solder (½ and ½), (case lots)	17.75	23.50	17.50
Babbitt metal (best grade)	70.00	35.50	35.00
Babbitt metal (commercial)	30.00	13.50	9.00

—Shop Materials and Supplies

MONEL METAL Base price in cents per pound, f.o.b. Bayonne, N. J.

Shots and blocks	$35.00	Hot rolled rods (base)	42.00
Ingots	38.00	Cold rolled rods (base)	56.00
Sheet bars	40.00	Hot rolled sheets (base)	55.00

Special Nickel and Alloys

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.00	9.50
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.00	7.00	7.00
Lead, heavy	3.25	3.00	3.00
Lead, tea	2.00	2.00	2.00
Brass, heavy	5.00	5.00	7.25
Brass, light	4.00	3.00	4.25
No. 1 yellow brass turnings	4.50	4.00	4.50
Zinc	2.50	2.00	2.50

TIN PLATES—American Charcoal Plates—Bright

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	21.50	.....	.....
IX,	20x28, 112 sheets	24.00	.....	.....
IXX,	20x28, 56 sheets	13.75	.....	.....
IXXX,	20x28, 56 sheets	15.50	.....	.....
IXXXX,	20x28, 56 sheets	17.00	.....	.....
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	18.50	.....	.....
IX,	20x28, 112 sheets	21.50	.....	.....
IXX,	20x28, 56 sheets	12.25	.....	.....
IXXX,	20x28, 56 sheets	14.00	.....	.....
IXXXX,	20x28, 56 sheets	15.75	.....	.....
Coke Plates, Bright				
Prime, 20x28 in.:			(Base)	
80-lb,	112 sheets	13.60	.....	.....
90-lb.,	112 sheets	13.80	.....	.....
100-lb.,	112 sheets	14.00	6.50	.....
IC,	112 sheets	14.30	6.65	.....
IX,	112 sheets	16.30	.....	.....
IXX,	56 sheets	9.15	.....	.....
IXXX,	56 sheets	10.15	.....	.....
IXXXX,	56 sheets	11.15	.....	.....
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	$7.50	5.50	.....
IC,	14x20	7.75	5.75	.....
IX,	14x20	8.00	6.00	.....

SHOP SUPPLIES

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	—50%	50–10–5%	—60%
1⅛ and 1¼x3 in. up to 12 in.	—40%	60–10–10%	—55%
With cold punched sq. nuts	—30%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	—40%	.....	.. ..
Up to 1-in. diameter, with cold punched hex. nuts (plus std. extra of 10%)	—30%	.....	.....
Button head bolts, with hex. nuts	—20%	390 base	.....
Hex. head and hex. nut bolts	—20%	.....	.....
Lag screws, coach screws	—50–10%	.....	.....
Carriage bolts, all sizes up to 1 in. x 30 in.	—45%	60%	—55%
Bolt ends, with hot pressed nuts	—50%	.....	.....
Tap bolts, hex. heads	—20%	.....	.....
Rivets, $\frac{7}{16}$ in. dia. and smaller. *New list*	—50–10%	60–10%	—60–10%
Rivets, tinned	—50–10%	60–10%	—45%
Semi-finished nuts, all sizes	—70%	80%	.....
Case-hardened nuts	—60%	.....	.....
Washers, cast iron, ½ in., per 100 lb.	$5.00	$4.50 off	$4.50
Washers, cast iron, ⅝ in. and larger, per 100 lb	4.25	3.75 off	4.50
Washers, round plate, off list per 100 lb.	3.00	.....	.....
Nuts, hot pressed, sq.	Off list	2.00	2.25	3.00
Nuts, hot pressed, hex.	Off list	2.00	2.25	3.00
Nuts, cold punched, sq.	Off list	1.50	2.25	3.00
Nuts, cold punched, hex.	Off list	1.50	2.25	3.00
Rivets:				
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb		$4.40	.....	3.68
Cone heads, ditto		4.50	.....	3.78
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb		0.25	.....	....
⅞ in. diameter	*EXTRA*	0.15	.....	....
½ in. diameter	*EXTRA*	0.50	.....	....
1 in. long, and shorter	*EXTRA*	0.50	.....	....
Longer than 5 in	*EXTRA*	0.25	.....	....
Less than 200 lb	*EXTRA*	0.50	.....	....
Countersunk heads	*EXTRA*	0.35	.....	....
Copper rivets		50–10%	40–10%	50%
Copper burs		25–10%	15%	50%

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb.	.055@.09	.09	.10
Wiping cloths per M., 13¼x13¼	.....	55.00	55.00
Wiping cloths per M., 13¼x20½	.....	65.00	65.00
Sal soda, 100 lbs	2.10	3.00	2.65
Roll sulphur, 2-bbl. lots per 100 lb	2.55	3.25	2.75
Linseed oil, per gal., 5 bbl. lots	.78	.83	.80
Fire clay, Ottawa, per 100 lb	.80	.80	
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Coke, prompt furnace	$2.90@3.00	Connellsville	
Coke, prompt foundry	4.00@4.50	Connellsville	

MIDDLE ATLANTIC STATES

Del., Wilmington—The Atlas Powder Co. has awarded the contract for the construction of a 1 story 60x80 ft. laboratory building. Estimated cost, $20,000.

Md., Baltimore—The Adamantex Brick Co., Arbutus Ave., has awarded the contract for the construction of a 2 story, 162x268 ft. plant. Estimated cost, $150,000.

Md., Baltimore—The Hampden Laundry & Ice Mfg. Co., J. H. McFaul, Jr., Secy., 3648 Hickory Ave., recently incorporated, plans to build a factory for the manufacture of ice and ice cream, also a laundry.

N. J., Secaucus—The Bd. of Freeholders Hudson County, Jersey City, has awarded the contract for the construction of a laundry, including the installation of machinery, at County Alms House, here. Estimated cost, $45,892.

Pa., Philadelphia—C. P. Cochrane & Co., Kensington Ave. and Butler St., have awarded the contract for the construction of a 2 story, 27 x 42 x 47 x 52 ft. addition to factory, on Kensington Ave., for the manufacture of carpets. Estimated cost, $75,000.

Pa., Philadelphia—The Mayer Baking Co., 60th and Hazel Aves., has awarded the contract for the construction of a 3 story, 125 x 130 ft. bakery, on Thomas Ave. Estimated cost $140,000.

Pa., Phila.—The Tazewell Mfg. Co., Tazewell, Va., has awarded the contract for the construction of a 3 story, 60x200 ft. ginger ale bottling plant. Estimated cost, $70,000.

Pa., Pittsburgh—The Natl. Biscuit Co., 201-10th St., has awarded the contract for the construction of a 6 story factory at 409 Liberty Ave. Estimated cost, $75,000.

Pa., Pittsburgh—The North Pole Ice Co., Carson St., is receiving revised bids for the construction of a 6 story, 160 x 192 ft. ice storage plant, at 1218 West Carson St. Estimated cost, between $500,000 and $600,000. W. Griesser, 222 Meyron Ave., Archt. Noted June 2.

Pa., Pittsburgh—The Standard Underground Cable Co., Westinghouse Bldg., has awarded the contract for the construction of a 2 story, 40 x 100 ft. addition to factory on 16th St. Estimated cost, $15,000.

Pa., Pittsburgh—The Union Ice Co., North Side, is receiving bids for the construction of a 2 story, 70 x 163 ft. ice storage plant, on Beaver Ave. Estimated cost, between $90,000 and $100,000. C. G. Gerber, Engr.

Pa., Scranton—The Smith & Clark Co., 516 South Blakely Ave., is receiving bids for the construction of a 3 story, 60 x 100 ft. ice cream plant, on Wyoming and Poplar Sts. McCormick Co., Century Bldg., Pittsburgh, Archts. and Engrs.

Pa., Wilkesbarre—M. F. Fadden & Sons, Inc., will soon receive bids for the construction of a 2 story, 60 x 90 ft. plant on Wyoming St. and along the tracks of the Lehigh Valley R.R., for the manufacture of ice cream. McCormick Co., Century Bldg., Pittsburgh, Archts. and Engrs.

SOUTHERN STATES

Va., Richmond—E. K. Vieter, 1800 Simms Ave., has awarded the contract for the construction of a 2 story plant, for drying tobacco. Estimated cost, $40,000.

W. Va., Altavista—The Altavista Photo Play Co., c/o Meanor & Handlosser, Archts., Robson-Prichard Bldg., Huntington, is having plans prepared for the construction of a 1 and 2 story, 75x125 and 80x90 ft. moving picture plant, here. Estimated cost, $75,000.

La., New Orleans—The Washington Ice Co., 611 Louisiana, plans to build an artificial ice-making manufacturing plant on Cadiz and Freret Sts. Estimated cost, between $125,000 and $150,000. P. J. Wingerter, Ch. Engr. Architect not selected.

MIDDLE WEST STATES

Ill., East St. Louis—The Southern Illinois Milk Producers' Assn., Arcade Bldg., plans to build a 1 story factory. Estimated cost, $50,000. Architect not selected.

Ill., Joliet—The Coal Products Mfg. Co., Lockport Township, has awarded the contract for the construction of a 2 story, 64 x 67 ft. factory. Estimated cost, $25,000.

Ill., Chicago—The Cuneo Henneberry Co., J. F. Cuneo, Pres., 455 East 22nd St., has awarded the contract for the construction of a 6 story, 100x221 ft. printing plant at 2242-54 Cottage Grove Ave. Estimated cost, $750,000.

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Business News Department

American Machinist

Tenth Ave. at 36th Street

New York

O., Cleveland—The Cleveland Society for the Blind, 2275 East 55th St., has awarded the contract for the construction of a 2 story, 40 x 80 ft. factory, on East 55th St., for the manufacture of brooms. Estimated cost, $40,000. Noted Jan. 20.

O., Cleveland—Steve Hovanec, United Bank Bldg., will build a 2 story 40 x 105 ft. paint shop on West 50th St. and Lorain Ave. Estimated cost, $20,000.

O., Cleveland—S. H. Vehicle Co., 3291 East 65th St., has had plans prepared for the construction of a 1 story, 40 x 90 ft. factory, on East 65th St., for the manufacture of wagon repairs. Estimated cost, $15,000. Private plans.

O., Dayton—The Cream Fried Cake Co. has awarded the contract for the construction of a 1 story, 74x100 ft. bakery on Troy and Chapel Sts. Estimated cost, $45,000.

Wis., Barksdale—The Farm & Labor Assn., c/o E. Huff, Pres., is having plans prepared for the construction of a 2 story, 29x96 ft. factory for the manufacture of cheese, etc. Estimated cost, $30,000. Private plans.

Wis., Green Bay—The Amer. Lumber & Mfg. Co., South Pearl St., is receiving bids for the construction of a 2 story, 150x160 ft. factory and warehouse, on Pearl St. Estimated cost, $50,000. Private plans. Noted Aug. 25.

Wis., Hartford—The Portz Bros. Malt & Grain Co. has awarded the contract for the construction of a 4 story, 64x120 ft. condensory and pasteurizing plant. Estimated cost, $150,000.

Wis., Kenosha—P. Pirsch & Co., Fairfield Ave., will soon award the contract for the construction of a 1 story, 100x100 ft. addition to its factory to be used for an assembling plant. Estimated cost, $50,000. C. O. Augustine, Archt.

Wis., Menasha—The United Paper Corp., c/o J. S. Frankland, Pres., is having preliminary plans prepared for the construction of a 4 story, 60x110 ft. factory, (2nd unit) for the manufacture of paper. Estimated cost, $100,000. Private plans.

Wis., Milwaukee—The Best Block Co., 1228 Humboldt Ave., has awarded the contract for the construction of a 1 story, 50x60 ft. factory, (1st unit), on Keefe Ave. Total estimated cost, $40,000. Noted Aug. 18.

Wis., Milwaukee—H. C. Hengels, Archt., 425 East Water St., will soon award the contract for the construction of a 2 story 50x63 ft. addition to knitting factory, on Wells and 18th Sts., for C. Koeffler. Estimated cost, $25,000.

Wis., Nenah—E. A. Wettengel, 578 Pierce Ave., Appleton, is having plans prepared for the construction of a 1 and 2 story, 80 x 555 ft. paper mill, on Blair Spring site. Estimated cost, $800,000. Architect not announced.

Wis., North Milwaukee—J. Greenbaum Tanning Co. is receiving bids for the construction of a 2 story, 50x70 ft. tannery building. Estimated cost, $70,000. Private plans.

Wis., Sauk City—The Sauk City Canning Co. is having plans prepared for the construction of a 1 and 2 story cannery. Estimated cost, between $75,000 and $80,000. J. Dresen, Sauk City, Archt.

Wis., Shawano—The United Fruit Packing Co., c/o H. Opgenorth Pres., Sheboygan, is having plans prepared for the construction of a 2 story, 32x136 ft. factory for the manufacture of fruit boxes, etc. Estimated cost, $35,000. Private plans.

WEST OF THE MISSISSIPPI

Ia., Des Moines—G. L. Garton, Secy. School Bd., will receive bids until Sept. 27 for the construction of a 2 story, 240 x 360 ft. high school, including a boiler plant and manual training shop on South West 9th and Loomis Sts. Estimated cost, $700,000. Proudfoot, Bird & Rawson, 810 Hubbell Bldg., Archts.

Minn., Minneapolis—The Bd. of Park Comrs., J. A. Ridway Secy., City Hall, plans to build a 2 or 3 story storage building and laundry on Lyndale and Farmstead Sts. Estimated cost, $175,000. Architect not announced.

Mo., Joplin—Joplin Center Cord Tire & Rubber Co., 815 Main St., will remodel and build addition to its plant including equipment for the manufacture of tires. Estimated cost, $20,000. J. L. Courvoisier, Treas.

Mo., Rockville—The Keystone Products Co. plans to build a factory for the manufacture of soap. Estimated cost, $25,000. Architect not selected.